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ECLIPSE OF AUGUST 31, 1932. PROBABILITY OF CLEAR SKY AND SOME AVAILABLE LOCATIONS*

The U. S. Nautical Almanac Office has published a Supplement to the *American Ephemeris*, 1932, entitled Total Eclipse of the Sun, August 31, 1932. In addition to the data necessary for predicting the circumstances of the eclipse for any place, the Supplement contains a map showing the position of the path of totality across the Province of Quebec and New England.

The northeastern limit of the path passes near La Tuque, P. Q., crosses the St. Lawrence River forty miles west of Quebec, continues over the Rangeley Lakes and strikes the Maine coast at Boothbay.

The southwestern limit passes through the western suburbs of Montreal, crosses the upper end of Lake Champlain, and passes near St. Albans, Vt., Montpelier, Vt., Concord, N. H., Salem, Mass., and Chatham, Mass., at the heel of Cape Cod.

The center line of the path of totality passes three miles west of St. Alexis des Monts, crosses the St. Lawrence River ten miles east of Sorel, passes one mile west of Magog, P. Q., three miles east of Island Pond, Vt., one and a half miles east of the summit of Mt. Washington, N. H., two miles west of Fryeburg, Me., and strikes the coast at Cape Porpoise, two miles east of Kennebunk Port, Me.

The first consideration in selecting a station from which to make observations of the eclipse is, of course, the question of the probability of clear sky. A preliminary report on this subject was published last year. Records for seven years are now available. The results have been grouped by districts and are shown in Figure 1. The ordinates are percentages of clear sky at 3:30 in the afternoon. The observations extend from August 15 to September 15 of each year from 1925 to 1931, inclusive. The full line shows the mean of all the results and the dotted line the mean for the week of the eclipse only. The points on the curve have quite different weights. The record for the Province of Quebec is based upon observations at thirteen stations; Northern New Hampshire and Vermont, four; Maine inland, four; Maine and New Hampshire coast, twenty-six; and Cape Ann, six.

*This is a report of a committee appointed by the American Astronomical Society, consisting of Frederick Slocum (Chairman), Odin Roberts, and R. Meldrum Stewart. It is printed also in *Publications of the American Astronomical Society*, Vol. 7, No. 2.

From the 32-day means Quebec and inland Maine have slightly better records than the other regions, but the differences are of the order of the errors of observation and probably have little significance. From the 7-day mean Quebec has the lowest and inland Maine the highest, but again the difference is of the order of dispersion of the means from

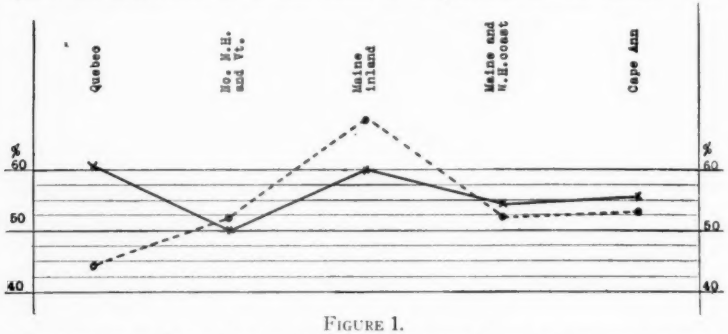


FIGURE 1.

PERCENTAGE OF CLEAR SKY AT 3:30 P.M. ALONG THE PATH OF TOTALITY OF THE ECLIPSE OF AUGUST 31, 1932, FROM SEVEN YEARS' OBSERVATIONS, 1925-1931.
(Full line for 32 days, August 15 to September 15. Dotted line for 7 days, August 28 to September 3.)

different stations in the same vicinity. The record from the summit of Mt. Washington for the seven years gives a mean of 38% for both the month and the week. This low record is not unexpected because of the well-known fact that clouds frequently form over the peaks of mountains in the middle of the afternoon.

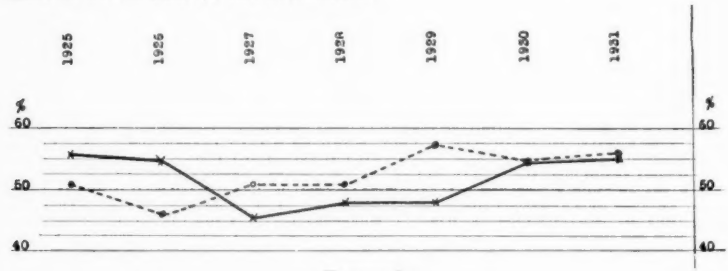


FIGURE 2.

COMPARISON OF THE PERCENTAGES OF CLEAR SKY FOR DIFFERENT YEARS ALONG THE PATH OF TOTALITY OF THE ECLIPSE OF AUGUST 31, 1932.
(Full line, stations along the Maine and New Hampshire coasts. Dotted line, stations in northern New Hampshire and Quebec.)

It will be safe to assume that the probability of clear sky will be about 55% along the whole path of totality with the exception of the region including the higher peaks of the White Mountains.

Figure 2 gives the 32-day means for two groups of stations for each

year, showing that there is very little difference from year to year and very little choice between the coast and inland stations. The Mt. Washington record is omitted from both figures.

The "cloudiness" in this whole section may be due to one of four causes. First, to storms that travel along the northern boundary of the United States and pass out the St. Lawrence Valley. These storms average one or two per week, and each lasts about 24 hours. They are accompanied by rain and moderately strong southeast and southwest winds. Secondly, to "tropical" storms that come from the Gulf of Mexico or the Caribbean Sea. There are generally one or two of these storms in September, but they are relatively rare in August. They last about three days and are accompanied by heavy rain and very strong northeast to northwest wind. Third, to local fog. This sometimes forms during the latter part of the night, generally evaporates before noon, but occasionally lasts all day along the coast. Fourth, to convectional clouds. If the forenoon is clear and warm, cumulus clouds may form in the afternoon, with broken masses of sufficient density to obscure the sun. There are so many days of this type in August and September that it will be highly desirable that the observers should be widely scattered along the whole line.

The average rainfall for stations along the line is 3 to 4 inches per month for this time of year, except on the high mountains where it is 8 to 10 inches per month. The average temperature at 3:30 P.M. along the whole line from Maine to Quebec is 72° F.

As to locations, a few rough specifications may be given for a suitable station for scientific observers. Naturally it must be as near the center line as possible; in general not over fifteen miles from that line. It must be easily accessible by automobile, train or boat. It must have a relatively open space with a clear view of the sky. It must be near suitable living quarters. It must be somewhat isolated or capable of enclosure, to avoid too much interference from the curious public. Electricity and running water must be available.

The data for the eclipse for a mid-New England spot on the center line are as follows:

ECLIPSE OF THE SUN. AUG. 31, 1932.

Conway Center, N. H. 44° N, 71° W.

Beginning of eclipse	$2^h\ 19^m\ 33^s$ P.M., E.S.T.
Beginning of totality	$3^h\ 28^m\ 19^s$
End of totality	$3^h\ 29^m\ 58^s$
End of eclipse	$4^h\ 33^m\ 27^s$
Duration of totality	99 seconds
Width of path	102.6 miles
Altitude, 30°. Direction	18° S of W
Speed of shadow	2967 feet per second.

The Eclipse Supplement of the *Nautical Almanac* gives a formula for computing the duration of totality for points off the center line.

$$D = T\sqrt{1 - (b^2/a^2)}$$

where T is the duration at the nearest point on the central line, b, the distance in miles of the place from the central line, a, one-half the width of the path at the given place. T varies from 98 seconds at the Maine coast to 102 seconds near the St. Lawrence River. The corresponding variation in a is from 51.4 to 50.9 miles.

Using the round numbers, 100 seconds for duration on the center line,

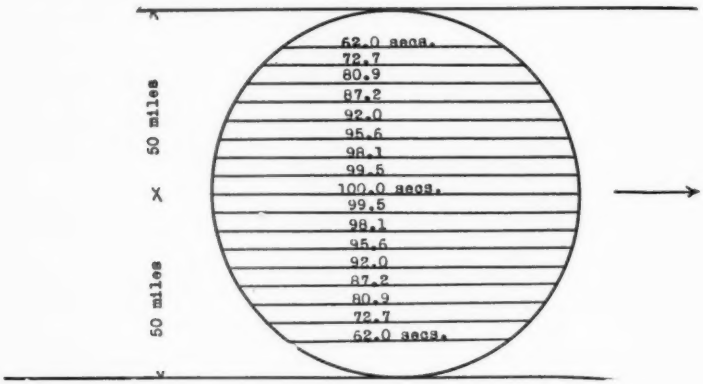


FIGURE 3.

and 100 miles for width of path, the diagram, Figure 3, has been constructed from the above formula, and may be used to tell at a glance the approximate duration of totality for places at any distance from the center line. The parallel lines are spaced at intervals of five miles. Thus a place five miles from the center line will have a duration only half a second less than the maximum; fifteen miles from the center line, 4.4 seconds less; ten miles from the outer edges totality will still last over one minute.

On the northeast shore of Cape Cod totality will last 60 seconds; tip of Cape Ann, 70 seconds; Portsmouth, N. H., 85 seconds; Portland, Me., 92 seconds; summit of Mt. Washington, 99 seconds; Newport, Vt., 98 seconds.

The committee has been along the path this summer, visiting many places within a belt extending roughly fifteen miles on each side of the center line and interviewing many people. Mr. Roberts and Mr. Slocum went from the Maine coast to the Canadian border and Mr. Stewart covered the Province of Quebec.

Figures 4 and 5 show road maps of these sections. The solid black lines are the limits of the path of totality; the dotted line, the center of the path. The path may be divided into four portions: first, a strip along the Maine coast; second, from the coast to the mountains; third, the White Mountains; fourth, from the mountains to and beyond the St. Lawrence River.

Taking them in order, the Maine coast, from York Beach to Cape Elizabeth is one of this country's most popular play grounds during

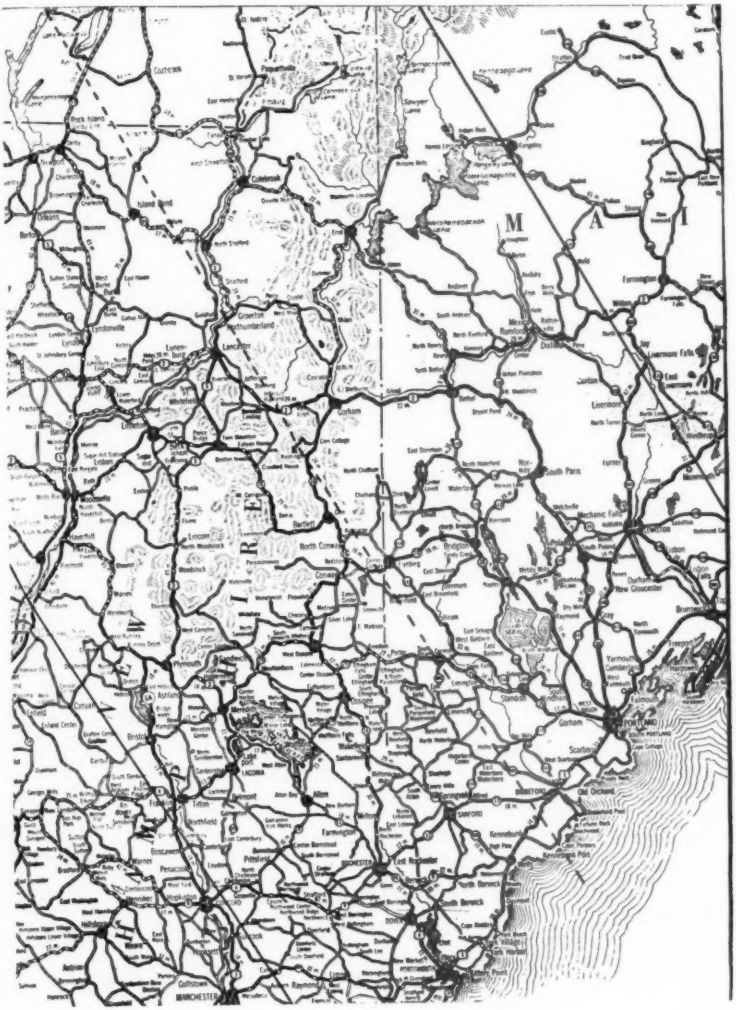


FIGURE 4.

August. Within that strip of 30 miles, there are about 200 hotels, 117 at Old Orchard Beach alone, and many of these will accommodate from 200 to 300 people. There are however, a few spots, as listed below, that

might be used by an eclipse expedition.

In the second section, we found little of interest for about 25 miles from the coast, but farther inland, there are many excellent locations in open rolling country varying from 200 to 500 feet in elevation. This includes the area bounded roughly by Limerick, Cornish, Baldwin, Douglas Hill, Bridgton, Broomfield, Fryeburg, Chatham, Jackson, Conway, and Chocorua.

In this region there are a number of small, but good, hotels and many farms that cater to tourists. In nearly every case there is, adjoining the hotel or farm, a field, garden or lawn suitable for the location of instruments. All of the hotels and most of the farms have electricity, 60 cycle, 110 volts.

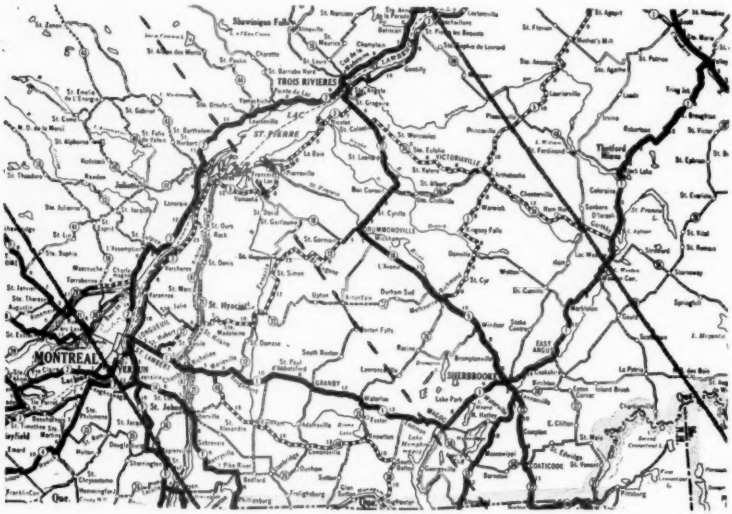


FIGURE 5.

The northern edge of this section is about 140 miles by road or train from Boston or Cambridge. The running time of the trains is about four hours.

The third section includes the White Mountains, a region about 50 miles across, in which there are many peaks or rounded domes, running up to 4000 and 6000 feet. The center line passes one and a half miles east of the summit of Mt. Washington (6290 feet). The probability of clear sky is, as has been stated, somewhat less than at lower levels, but when it is clear, the atmosphere is remarkably transparent and it will certainly be well worth while for someone to take a chance on the advantages of being a mile above the low level haze. The summit of Mt.

Washington may be reached by auto from Glen House on the east side, or by railroad from Base Station on the west side.

There are about 100 summer hotels within the western edge of the mountains, chiefly in the vicinity of Bethlehem, Bretton Woods, Fabyan, Twin Mountain, Whitefield, Franconia, Sugar Hill, and Crawford Notch. Many of these accommodate from 200 to 500 people. This region is not included in the accompanying lists.

From the White Mountains north the country is rather open and rolling with some hills and many picturesque lakes. The elevation of the villages and towns varies from about 1000 feet just north of the mountains down to near sea level at the St. Lawrence River and then up to 1400 feet where the Canadian National R.R. crosses the eclipse path, about 150 miles beyond the river. As in the case of the section southeast of the mountains, this region is rich in good locations near small hotels, country clubs, farms, and camps. This is true of both northern New England and the Province of Quebec.

The most northerly location that is easily accessible is the little town of Parent in Lat. 48° N, Long. 74° 48′ W, about 10 miles west of the center line. It is a divisional station on the Canadian National R.R., ten hours from the city of Quebec. With the exception of Parent all the places mentioned in this report may be easily reached by automobile, and most of them have direct railroad connection. There are many excellent road maps, as for example, The Highway and Tourist Map published by the Minister of Roads, Quebec; the maps published by the individual New England States; the Automobile Blue Book, and the road maps issued by the various gasoline companies.

Below are given two lists of locations; the first, within five miles of the center line; the second, more than five miles from the center line. In both, the towns are given approximately in the order of their distance from the Maine coast. For places in the first list the duration of totality ranges only from 98 to 102 seconds. In the second list the duration is given for stations in the United States. The figure after the names of the towns indicates the population; after the names of the hotels in Quebec, the number of rooms; after the New England hotels, the number of people that can be accommodated.

The rates have not been given. The average for the tourist farms and small hotels is about $3 per day, for room and three meals; for the larger hotels, $5 to $10 per day.

The following lists make no pretense to being complete. The committee traveled over a portion of the path about 250 miles in length, but obviously could not visit all possible suitable locations in the 7500 square miles of a zone thirty miles wide. It is hoped, however, that the information given herein may be of some assistance to those who are planning to observe the eclipse. The latter part of August is the peak of the normal summer tourist season in New England and Quebec.

Next summer with the added attraction of the eclipse it will be advisable to make reservation as early as possible.

LIST OF SOME SUITABLE LOCATIONS *Within Five Miles* OF THE CENTER LINE.

Kennebunk, Me. 3000. Four miles west of line and four miles from the coast. On Boston and Maine Railroad. Busses run to Kennebunk Beach, 4 miles, Kennebunk Port, 4 miles, and Cape Porpoise, 5 miles.

For local information in regard to the above places consult Mr. Arthur L. Leach, Sec. Chamber of Commerce, Kennebunk, Me.

Cape Porpoise, Me. 650. On center line. Langford House (75), Sinnett House (20). Picturesque fishing village. Several knolls suitable for location.

Kennebunk Port, Me. 1400. Two and a half miles west of line. Oceanic Hotel (200), Arlington Hotel (90) and many other summer hotels. Popular summer resort. Some open spaces, but isolation may be difficult.

Kennebunk Beach, Me. Four miles west of line. The Narragansett (200), Sea View Hotel (150) and others. Summer colony.

Biddeford Pool, Me. 500. Five and a half miles east of line. Reached from Biddeford, seven miles. A fishing and summer colony. Ocean View Hotel (100).

For information write to Captain of Fletcher's Neck Coast Guard Station.

Biddeford, Me. 18,000. Three miles east of line. Thacher Hotel (100). On Boston and Maine Railroad.

Saco, Me. 6800. Four miles east of line. On Boston and Maine R. R.

Limerick, Me. 760. Three miles west of line. Shade of the Elm Inn (20). Ten miles from the nearest railroad station, Westcott, on the Boston and Maine R. R. Open country with several tourist farms near the village.

Office of the Central Maine Power Co. Reference, Mrs. Alice E. Boynton, Librarian.

Cornish, Me. 800. One mile east of center. Reached by Maine Central R. R. The New Lincoln (20). Open country, tourist farms.

Reference, Mr. L. C. Ayer, Chairman of Selectmen.

Kezar Falls, Me. 618. Three miles west of line. Millville Hotel (20). Five miles from West Baldwin on the Maine Central R. R. Open country.

Reference, Mr. O. L. Stanley, President of Bank.

West Baldwin, Me. 500. Three miles east of line. On Maine Central R. R. Open country.

Reference, Rev. B. F. Wentworth, West Baldwin.

Hiram, Me. 920. Four miles east of line. On Maine Central R. R.

Reference, Rev. B. F. Wentworth, West Baldwin.

East Broomfield, Me. 368. Three miles east of line. Stickney Tavern (30). On Maine Central R. R. Open country to the west through Broomfield (800) and across the line to West Broomfield.

Reference, Secretary of Chamber of Commerce, East Broomfield.

Fryeburg, Me. 600. Two miles east of the line. Fryeburg Tavern (30), Ye Olde Inn (30). On the Maine Central R. R. Elevation 500 feet. Twelve miles southeast of the foothills of the White Mountains. Open spaces in the village and on the neighboring farms.

Reference, Proprietors of the above hotels.

Center Conway, N. H. 300. Two miles west of the line. Lake View Cottage (10). Reached from Fryeburg or Conway. Open country and farms.

Reference, Mr. L. T. Garland, Postmaster.

Conway, N. H. 300. Five miles west of line. Presidential Inn (100). On Boston and Maine R. R. Many tourist farms near by, especially on Tasker Hill.

Reference, Mr. Arthur W. Evans, Sec. Chamber of Commerce.

North Conway, N. H. 900. Three miles west of line. On Boston and Maine R. R. and the Maine Central R. R. Hotel Randall (150), New Robertson Inn (35) and many other hotels, camps and farms. "A summer and winter playground."

Reference, Secretary, Board of Trade.

South Chatham, N. H. 300. Three miles east of line. Reached from Fryeburg, Me., or North Conway, N. H. Haslam Camps (20).

Reference, Miss Emily B. Haslam, Winter address, 82 Prospect St., Stamford, Conn.

Kearsarge, N. H. 200. One and a half miles west of the line. Reached from North Conway. Russell Cottages (125), Kearsarge Mt. Inn (40) and many other small summer and winter hotels and farms.

Intervale, N. H. 200. Three miles west of the line. On the Boston and Maine R. R. The Bellevue (100), Pendexter Mansion (60) and other summer and winter hotels and cottages.

Jackson, N. H. 200. One mile west of the line. On Boston and Maine R. R. Station Glen and Jackson. Eagle Mt. House (225), Spruce Mt. Lodge (60) and many other summer and winter hotels. Within the southeastern edge of the White Mountains.

Mt. Washington, N. H. Summit, one and a half miles west of the line. Halfway house, one-half mile east of line. Reached by Boston and Maine R. R. or Maine Central R. R. to Bretton Woods, N. H. and Mount Washington R. R. to the summit, or by auto road from Glen House. Summit House (100), Tip-Top House (50). Elevation of summit 6290 feet.

Reference, Mr. A. D. Wright, Summit House.

Randolph, N. H. 300. Three miles east of line. The peak of Randolph Mt., 3280 feet, is three and a half miles east of line. The hotels and cottages on Randolph Hill have an elevation of about 1800 feet. Ravine House (125), Mount Crescent House (60), Mountain View House (30). Randolph is in the midst of the mountains between the Randolph and Presidential Ranges.

Reference, Professor J. Q. Stewart, winter address, Princeton University, Princeton, N. J.

Jefferson Highlands, N. H. 900. Two miles west of line. On Boston and Maine R. R. Elevation, 1800 feet. On the western slope of Bois Mt. Highland House (60), Bois Mt. Farm (25) and others.

Jefferson, N. H. 900. Two and a half miles west of the line. On Boston and Maine R. R. Elevation, 1500 feet. On the western slope of Mt. Starr King. Waumbek Hotel (250), Pliny Range House (60) and others.

Lancaster, N. H. 2800. Three miles west of line. On Boston and Maine R. R. Lancaster Inn (125), The Elms (75) and others. Elevation 860 feet. On the northwestern edge of the White Mountains. Tourist farms on the outskirts.

Reference, Mr. David White, Editor "Coos County Democrat."

Groveton, N. H. 2500. Three miles east of line. On Boston and Maine, Canadian Pacific and Grand Trunk R. R.'s. Eagle Hotel (40), Union Hotel (20). Many tourist farms in and around the village.

Reference, Miss Fontie Wilkinson, Town Clerk.

Stratford, N. H. 790. Three miles east of line. Reached from North Stratford. Merriam Farm (10), Kimcrest (10). Open rolling country.

North Stratford, N. H. 475. Four miles east of line. On the Canadian Pacific and Grand Trunk R.R.'s. Stratford Hotel (28), Stone Ledge (10). Open rolling country. Elevation 900 feet.

Reference, Mr. J. C. Hutchins.

Bloomfield, Vt. 380. Four miles east of line. Reached from North Stratford, N. H. Sunnyside (20).

Island Pond, Vt. 1800. Two and a half miles west of line. On Grand Trunk R. R. Brookside House (8), The Pines (8).

Reference, Mr. George Dyer, Town Clerk.

Morgan Center, Vt. 200. Two and a half miles west of line. Reached from Island Pond or Newport, Vt. On the east side of Seymour Lake. The Center House (20). Several camps, cottages and boarding houses around the lake.

Reference, Mr. J. A. Calkins, Proprietor of the Center House.

Morgan, Vt. 200. Four miles west of line. Reached from Island Pond or Newport, Vt. On the north shore of Seymour Lake. Elevation 1300 feet. Ouananiche Inn (20).

Derby, Vt. 300. Six miles west of line. Reached from Newport, Vt., on the Canadian Pacific or Derby Line, Vt., on the Quebec Central R. R. Elevation 900 feet. Kingsberry Farms (40), a golf club hotel.

Derby Line, Vt. 600. Four miles west of line. On Quebec Central R. R. Station, Rock Island, Derby Line and Stanstead. Haskell Homestead (10). Several tourist farms between Derby and Derby Line.

Magog, P. Q., Canada. 6500. One mile east of central line. Elevation 700 feet. Battle's House (45), Union House (60). On Canadian Pacific R. R. Surrounding country very rolling. Open fields with clear view along east shore of Lake Memphremagog.

Reference, Judge E. E. Howard, past president of the Montreal Centre of the Royal Astronomical Society of Canada.

Actonvale, P. Q. 1500. Two miles west of central line. Elevation approximately 200 feet. Hotel Windsor. On Canadian National R. R. Country level in all directions. Open fields are available near the town with a clear view to west and southwest.

Yamaska, P. Q. Three miles west of central line. Elevation 50 feet. Yamaska Hotel (15). On Quebec, Montreal and Southern R. R. Surrounding country flat and open.

Pierreville, P. Q. 1400. Three miles east of central line. Altitude 75 feet. Hotel Manoir (12), Hotel Central (15), Hotel Belisle (15). On Quebec, Montreal and Southern R. R. Situated on the east bank of the St. Francis river. Country to the east flat with some woods.

St. Francois, P. Q. 700. Two and a half miles east of the central line. Elevation 75 feet. Tourist cabins and farms. On the Quebec, Montreal and Southern R. R. Ferry across St. Francis river to Pierreville. Country to west of village flat. Locations available with clear view to west and southwest.

Abenakis Springs, P. Q. 64. One and a half miles east of central line. Elevation approximately 100 feet. Abenakis Springs Hotel (50). Located on St. Francis river. Land outside river valley mostly level. Open fields with clear view to west and southwest.

Maskinonge, P. Q. 1000. A half mile east of central line. Elevation 50 feet. Hotel Laurier (15). Tourist farms. Open fields immediately to west.

Louiseville, P. Q. 1800. Four and a half miles east of central line. Elevation 40 feet. Windsor Hotel (36), LaFleur Hotel (27), Canada Hotel (25). On Canadian Pacific R. R. Country level. Open fields along highway to east and west.

St. Alexis des Monts, P. Q. 4000. Three miles east of central line. Elevation approximately 600 feet. Two small hotels. In Laurentian foot-hills; surrounding country rolling. Open fields available on highway near village.

LIST OF SOME SUITABLE LOCATIONS *More Than Five Miles* FROM THE CENTER LINE.

Douglas Hill, Me. Twelve miles east of line. Reached from Mattocks Station on the Maine Central R. R. Elevation 1400 feet. Duration of totality 95 seconds. Douglas Inn (70).

Reference, Mr. Orville B. Denison, Proprietor of the Douglas Inn.

Bridgton, Me. 450. Fourteen miles east of line. On Maine Central R. R. Elevation 360 feet. Duration of totality 95 seconds. Stoneleigh Manor (55), Highland Lodge (40). Tourist farms between Bridgton and West Bridgton, six miles west of Bridgton and ten miles from center line.

Mount Whittier, N. H. Sixteen miles west of line. On Boston and Maine R. R. Duration of totality 94 seconds. Railroad center for an open valley between the Ossipee and White Mountains. Hotel Tamworth (75), Tamworth, N. H. Chocorua Inn (125), Chocorua, N. H.

Madison, N. H. Nine miles west of line. On Boston and Maine R. R. Elevation 470 feet. Duration of totality 97 seconds. The Lakeside (65), Madison, N. H. Wing's Tavern (75), Pequaket, N. H.

Bartlett, N. H. 1000. Eight miles west of line. On the Maine Central R. R. Elevation 680 feet. Duration of totality 97 seconds. In a broad open valley running east and west at the lower end of the Crawford Notch. Howard Hotel (50). Many small hotels and tourist farms in good open country between Bartlett and North Conway.

Lovell, Me. 575. Ten miles east of line. Reached from Fryeburg, Me. Elevation 700 feet. Duration of totality 97 seconds. Farrington's Hotel. Conifer Camp on Kezar Lake (40).

Gorham, N. H. 2700. Eight miles east of line. On Boston and Maine and Grand Trunk R. R's. Elevation 800 feet. Duration of totality 97 seconds. Mount

Madison House (100), Glen House (50). On the western edge of the White Mountains.

Reference, Mr. M. M. Willis, Town Clerk.

Berlin, N. H. 16,000. Eleven miles east of line. Elevation 1000 feet. Duration of eclipse 97 seconds. On Boston and Maine R. R. Berlin House (100), New Revere Hotel (40). Open country on the outskirts of the town.

Reference, W. B. Van Arsdel, Research Department, Brown Co.

Whitefield, N. H. 1900. Ten miles west of line. Elevation 950 feet. Duration of totality 97 seconds. On Boston and Maine R. R. Mountain View House (375), Hotel Spruce (60). Small hotels and tourist farms in the vicinity. Within the western edge of the White Mountains.

Reference, Judge Edgar M. Bowker.

Westmore, Vt. 280. Eleven miles west of the line. Elevation 1200 feet, with hills in the vicinity running up to 2600 feet. Duration of totality 98 seconds. On the east shore of Willoughby Lake. Reached from Barton, Vt., on the Canadian Pacific R. R. Willoughby Hotel (35), P. O. Orleans, Vt., R. F. D. 2.

Colebrook, N. H. 1800. Fifteen miles east of line. On the Maine Central R. R. Elevation 1000 feet. Duration of totality 96 seconds. The Monadnock Hotel (70), Colebrook House (60). A picturesque town on the Connecticut River, near the western edge of the mountains. Open spaces in the town and surrounding country.

Reference, Mr. Darwin Lombard, President, Farmers and Traders Bank.

The Balsams (800) at Dixville Notch, ten miles from Colebrook. Elevation 2000 feet. Duration of totality 90 seconds. Good location at Country Club on Golf Course.

Reference, Capt. Frank Doudera, Proprietor of the Balsams.

Averill, Vt. 100. Twelve miles east of center line. Elevation 2000 feet. Duration of totality 97 seconds. Reached from Norton Mills on the Grand Trunk R.R. Quimby's Cold Spring Club (100).

Newport, Vt. 4970. Twelve miles west of center line. Elevation 700 feet. Duration of totality 97 seconds. On the Canadian Pacific R. R. The Newport Hotel (150), in the center of town. Open country in the suburbs with many tourist farms.

Reference, Mr. C. C. Cummings, Publicity Director, Propagation Commission.

Stanstead, P. Q., Canada. 800. Five and a half miles west of the central line. Altitude approximately 700 feet. Stanstead Inn and the Maples (40). On Boston and Maine R. R. On a small plateau surrounded by open rolling country. Here is situated Stanstead Wesleyan College, a preparatory school for boys and girls. Though no college grounds are available for mounting instruments, arrangements could be made for the use of dormitories by eclipse parties.

Coaticook, P. Q. 4000. Ten and a half miles east of central line. Altitude 1000 feet. Several hotels. On Canadian National R. R. Surrounding country very rolling, offering no difficulty in the selection of eclipse sites.

Compton, P. Q. 500. Thirteen miles east of central line. Altitude about 725 feet. Reached by Canadian National R. R. Surrounding country very rolling. Here is situated Compton school for girls. Fields in connection with the college would be available for eclipse parties, and arrangements could probably be made for the use of the college dormitories.

Lennoxville, P. Q. 1600. Seventeen and a half miles east of central line. Altitude 500 feet. Tourist accommodations but no hotels. Bishop's College University is located here. College facilities including dormitories and a physical laboratory for testing purposes can be obtained by eclipse parties. There is a large field on the grounds to the southeast of the college building, which would be suitable for instrumental equipment.

Knowelton, P. Q. 800. Fifteen miles west of central line. Altitude 680 feet. Lake View House (42), Knowlton Inn (30), Robinson's Hotel (25). On Canadian Pacific R. R. Situated on southern shore of Brome Lake. Country rolling, excellent view to west and southwest from many points along east shore of lake.

Waterloo, P. Q. 2000. Ten miles west of central line. Elevation 675 feet. Three hotels. On Canadian National R. R. Surrounding country moderately rolling, affording various locations with clear eclipse view.

Granby, P. Q. 10,000. Seventeen and a half miles west of central line. Altitude approximately 200 feet. Two hotels. On Canadian National R. R. Surrounding country slightly rolling.

Abbottsford, P. Q. 300. Twenty-three miles west of central line. Altitude 200 feet. On Canadian Pacific R. R. and Montreal and Southern Counties Electric R. R. Surrounding country level. Open fields along highway with good outlook.

Richmond, P. Q. Sixteen and a half miles east of central line. Altitude about 400 feet. Hotels: Brunswick, Richmond, St. Jacobs, and Grand Central. On Canadian National R. R. In the St. Francis river valley. Back from the river in either direction the country is flat above the level of the valley. Open fields at the top of the elevation with a good view to the west and southwest.

St. Hyacinthe, P. Q. 14,000. Eighteen miles west of central line. Altitude about 100 feet. Ottawa Hotel (35), Grand Hotel (50), Hotel Canada (40), Union Hotel (28). On the Canadian National and Quebec, Montreal and Southern R. R.'s. Surrounding country level and open.

Drummondville, P. Q. 6000. Ten miles east of central line. Altitude about 300 feet. Manoir Hotel (50), New American Hotel (36), Grand Central Hotel (25). On Canadian National R. R. Surrounding country mostly level and open, very slightly undulating.

Nicolet, P. Q. 2300. Seventeen and a half miles east of central line. Altitude 75 feet. Three hotels. Reached by Quebec, Montreal and Southern R. R. Surrounding country mostly flat with occasional woods.

Sorel, P. Q. 9500. Ten miles west of central line. Elevation 50 feet. Balmoral Hotel (50), Carleton Hotel (25), Quebec Hotel (25). Situated at the mouth of the Richelieu river. On the Quebec, Montreal and Southern R. R. Open fields to the southwest, with woods interspersed.

Berthier, P. Q. 3500. Eleven and a half miles west of central line. Elevation 35 feet. Manoir Hotel (40), Canada Hotel and Victoria Hotel. On Canadian Pacific R. R. Level fields along highways to west and north.

Yamachiche, P. Q. 900. Ten miles east of central line. Altitude 30 feet. Hotel Belleview (20). On Canadian Pacific R. R. Surrounding country level with open fields.

St. Barthelemi, P. Q. Five and a half miles west of central line. Elevation 35 feet. Three hotels. On Canadian Pacific R. R. Country flat and open.

GOD REIGNS!

When we survey the azure sky,
The golden sun's unchanging course,
Which paints the clouds as night draws nigh
And chains our planet with its force;
When we survey the ocean blue,
Or rainbow over dale and dell,
We feel, we know that it is true,
God reigns on earth, and all is well.

When we survey the skies of night,
The silver moon's romantic gleam,
Which, rising beautiful and bright,
Makes mortal man to muse and dream;
When we survey the stars aglow,
Like jewels over fen and fell,
We do not doubt, we feel, we know,
God reigns above, and all is well.

CHARLES NEVERS HOLMES.

41 Arlington St., Newton, Massachusetts.

The Christian Advocate, New York City, July 2, 1924.

THE CALENDAR SIMPLIFIED

By WILLIAM B. PARMELEE.

The calendar as we have it today has stood unchanged for over one hundred and seventy-five years. We are still paying homage to Caesar. It has many faults, most of which are entirely unnecessary. Many schemes for its improvement have been suggested. Some propose a year of thirteen months. Shall the twelve month year which has been in efficient service for over twenty-six hundred years be discarded without careful inquiry lest the remedy create more evils than it cures?

The making of a satisfactory calendar is no easy task. The day, which is the most primitive and obvious unit of time, is not invariable in length. Owing to the ellipticity of its orbit the earth travels faster in winter than in summer. The invariable speed of rotation about its axis taken in connection with its variable speed of revolution in its orbit brings the sun to the meridian a half hour earlier at one extreme than at the other. So noonmarks and sundials are in error by about fifteen minutes at these times. Almanacs indicate this by the expressions "sun fast" and "sun slow." Clocks in order to keep steady hours must average the times of the sun's goings and comings, thus giving us what is called "mean sun time" and the day of 24 hours which is the average length of the periods between successive transits of the same meridian by the sun throughout the year.

This average day is taken as the standard day, and is the one always meant unless otherwise specified. The next most obvious unit of time must have been the period of the moon's recurrence to the same phase, giving us the month (moonth). Later as people dispersed farther from the tropics the changes of the seasons would be noticed. Thus the year was recognized. All of these are astronomical periods but unfortunately for the calendar maker they are mutually incommensurable, and to add to his difficulties only the year is of inflexible length. So he must adapt an inflexible artificial standard day to an inflexible astronomical year which can never be measured in terms of days exactly. Any attempt to bring the moon's period into the scheme baffles him for it can not be measured in terms of days or years and furthermore is slowly changing. The period from full moon to full moon is approximately 29.53 days which can not be fitted into either a 13-month year with 28-day months or a 12-month year with 30- and 31-day months, but agreeing more nearly with the latter. So the moon must be ignored. The remaining unit of time in common use—the week—is not an astronomical period at all, its origin doubtful. But it is so convenient and so thoroughly intrenched that no system of time reckoning can ignore it. But it is not an aliquot part of the year or month and so cannot be made to

harmonize perfectly with either. Dates controlled by the moon must be found by calculation.

The principal defects of the present calendar are:

That no year is the duplicate of any other year except at irregular intervals sometimes six years apart and twice as often eleven years apart, thus making it practically impossible to memorize it, and necessitating the printing of calendars for each year at a cost of millions of dollars.

That the anniversary of an event seldom falls on the same day of the week as the event itself, but roams over the entire week. It will recur on the same day but eleven times in a century, and the day of a future event can be foretold only by a laborious process or by reference to carefully prepared schedules not often readily accessible.

That the year cannot be divided into equal halves, quarters, thirds, sixths or twelfths. There is no standard month, no standard quarter, no standard half-year. The month may comprise 28, 29, 30, or 31 days. It may have as few as 24 business days or as many as 27 without taking into account holidays which of course vary in different months and different countries and cannot be considered in the making of a calendar. Business transactions involving time units need standard units in order that the result of operations during one unit of time may be directly comparable with the output of any or all other such units without requiring corrections for the unequal times as at present. Our calendar in this respect is about as bad as possible.

All anniversaries and fixed dates now sometimes fall on a Sunday, occasioning their celebration in a manner offensive to many, or its change to another date.

Legal and other periodical dates cannot be set on a fixed date but resort must be had to circumlocutions like "the first Monday after the first Tuesday," and "or if said day be a legal holiday then on the next succeeding day not a holiday."

Quoting from an advocate of a 13-month calendar: "The variations in the length of the month cause the most difficulty to business. There is a difference of 11% between the length of February and the length of March. There is an even greater difference between the number of working days which is the important factor in industry." "All calculations of salaries, interest, insurance, leases which are fixed on a monthly, quarterly or half-yearly basis are inaccurate and do not correspond with one twelfth, one quarter or one half of the year."

All of these defects are unnecessary and easily avoidable. By an extremely simple method, suggested, it seems, by several persons independently, which is in substantial accord with some eight other similar schemes that have been presented to the League of Nations, all of these objections are eliminated and no new ones introduced. Here it is.

Going into effect January 1, 1934, every January, April, July, and October thereafter will begin on Monday, end on Tuesday, have 30 days, 26 of them working days and 4 Sundays. Every February, May,

August, and November will begin on Wednesday, end on Thursday and have 30 days, 26 of them business days and 4 Sundays. March, June, September, and December will begin on Friday, end on Sunday and have 31 days, 26 of them working days and 5 Sundays. If one saves the calendars for June, April, and May of this year he will have a perfect perpetual simplified 12-month calendar for the first, second, and third months of each quarter respectively for every year thereafter.

Here,then, is the complete calendar, good for all time.

JANUARY
APRIL
JULY
OCTOBER

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

FEBRUARY
MAY
AUGUST
NOVEMBER

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

MARCH
JUNE
SEPTEMBER
DECEMBER

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

The next day after December 31st (by the new calendar, 30th by the old) will be New Year's Day, an international holiday, a *dies non*, not a part of any week or month, but simply New Year's Day, (though some would call it January 0) and as completely ignored commercially and industrially as if Father Time himself had taken a day off. The next day after June 31 on leap years will be another international holiday just like New Year's Day but called Leap Year Day or perhaps Midyear Day. As both of these holidays follow a Sunday it will add a day to the week-end at those times. That is the simplified 12-month calendar in a nutshell.

Notice that every year is exactly like every other year except for the extra day of leap year which functions solely to enable the calendar to keep pace with the sun. Being a zero day, a *dies non*, it does not have any effect on the calendar.

Notice that only three monthly schedules make a complete perpetual calendar, these schedules are very easily memorized. Printed calendars except for memoranda will become obsolete.

Notice that the anniversary of every event thereafter will forever occur on the same day of the week as the event itself.

Notice that each month of the entire year has exactly 26 working days, giving business the standard month which it asks for. The 31-day months only have five Sundays. Each half year will be exactly like the other half no matter where the dividing line be drawn. Divide the year into quarters wherever you will, each will be exactly like every other one with the same number of working days and the same number of Sundays.

Notice that no historical date need be changed, as, e.g. was the case at the time of the last revision of the calendar in 1752 when Washington's birthday had to be shifted from February 11 to February 22. It can deviate from its strict anniversary no more than it does now.

Notice that recurring events, like elections, inaugurations, meetings and so forth can be given fixed dates without circumlocutions.

The old calendar will glide into the new without any shock to business, indeed with changes so slight as to be scarcely noticeable by anybody. The change would cause little if any more confusion than the recurrence of the 29th day of February.

It may be thought that the interposition of New Year's Day before January first would cause a shifting of all the days of the year from their accustomed places, but as 1934's 365th day will be New Year's Day, 1935 and ever after, January 1st will be the first day of the year as before and the only shifting of dates will be due to the changes in the length of the months. Except for the final days, the days of January, June, August, and October will occupy exactly the same place in the year as at present. The corresponding dates of February, September, November, and December will be shifted one day ahead of their place in the present calendar, and those of March, April, May, and July will lag one day behind. June first will be the 152 day of the year then as now. July Fourth will be the 186th day of the year instead of the 185th and Christmas will be the 358th day instead of the 359th.

It takes the earth nearly six hours more than 365 days to return to a given point in its orbit. Hence it may easily happen that the exact anniversary of an event may not occur until a year and a day according to the calendar. In order to curb this tendency to outrun the earth, the calendar is given a handicap of one day every fourth year in a futile attempt to make it keep pace with the earth. But in spite of all handicaps and corrections extending over a period of 400 years, the exact astronomical anniversary of an event may wander over a range of four days. Thus under the present calendar the vernal equinox, which is a fixed point in the earth's orbit may occur on March 19, 20, 21, or 22. Furthermore due to the international date line it may occur on two or even three different days at the same time. So any anniversary celebrated on a fixed date is more likely to be wrong, strictly speaking, than right over a long span of years. No one who accepts the present calendar whose vagaries cover four days can reasonably object to the new in which some months are dislocated from the old by only one day, for it

is not as great as that to which they are accustomed to without realizing it.

The substitution of a 13-month calendar for the 12-month one would be attended with very great confusion while the world was trying to adjust itself to it. This is readily admitted by its sponsors. A generation at least would pass before it could be universally established. Consider how long it took standard time to be generally adopted. How people did like to prate about "God's time" which they could not have defined to save their lives. But the difference between adopting standard time and adopting a 13-month calendar would be fairly comparable to the difference between moving the long pointer of the clock a few minutes (which in fact was all there was to do to adopt standard time) and wrecking the clock to build a new one out of its ruins with a thirteen hour face.

It would create havoc in the financial world, for every bond, every certificate of stock carrying a date for payment must be called in, the plates reengraved, reprinted, individually filled out, signed and returned to the owners. A prodigious task at an appalling cost. The alternative would be the use of the two calendars side by side till the certificates were called in and the bonds retired, which might well be a century hence.

All interest tables, wages tables, astronomical tables and all calculations based on the 12-month year must be replaced. The difficulties of computing interest having to work with thirteenths instead of with halves, thirds, quarters, sixths and twelfths must be experienced to be appreciated. Try it.

All arithmetic, tables and rules for computing interest must be scrapped and new ones published when one month equals a thirteenth of a year.

All monthly periodicals published in two volumes a year must comprise alternatively six and seven numbers or else publish but one volume a year. The cost of getting out thirteen numbers a year instead of twelve will be increased by 8⅓% and the price could hardly be advanced less than 10% to avoid awkward figures. In all probability it would be raised to the nearest multiple of fifty cents.

The twelve signs of the zodiac will have to be redistributed, each month covering a fraction of one or two signs, but never coinciding with any one of them.

A great many laws must be revised, adjustments for contracts, leases, insurance policies, notes and all sorts of legal obligations must be made. When an insurance policy, contract, lease or promissory note reaches maturity must be settled in the courts and new rules made for nearly every date. No generalized law could be devised, for the dislocation of dates from their established position in the year would run all the way from one to fifteen days forward or backward, and an entire new month taken into consideration.

Dividends payable on the first of each quarter will become due on January 1, Sunday; April 8, Sunday; Sol 15, Sunday; and September 23, Monday.' All other dividend dates would be equally irregular as to the day of the month. With the simplified 12-month calendar all quarterly dates will fall not only on the same day of the week but also on the same day of the month. In Spanish speaking countries the year is divided into "tercios" or thirds. These will be as impossible as quarters without splitting months.

With the 13-month calendar in vogue, Lincoln's birthday will be shifted to February 13, Washington's to February 26, Memorial Day to June 11, and we will buy fireworks to celebrate the glorious 18th of Sol!

The thirteen month calendar sacrifices everything to get 13 perfect months of exactly four perfect weeks. But does it get them? February is mutilated by two legal holidays, May, July, September, October, November, and December by one each. How distressing to the maker of a perfect calendar!

The 13-month calendar introduces a year that can be split only into the most unworkable fractions of thirteenths, and upsets every date in the calendar, except New Year's, not in an orderly uniform manner, but irregularly from one to fifteen days forward or backward in a most confusing manner.

By comparison the simplified twelve month calendar proposes a standard business month of 26 days each, the year to comprise twelve such months, hence divisible into two, three, four or six equal parts, each part subdivisible and all making the most convenient and workable fractions possible. No calendar date will be shifted from its present position in the year more than one day and that is not as much as the present calendar is shifted by reason of the unmanageable fraction of a day, which is necessary to complete a year, and the international date line (for though I am writing this on Monday it is Tuesday over a large part of the world right now), and for one fourth of the year there will be no change whatever. Yet it adds very much to the convenience of the calendar and introduces no drastic change or any objectionable features whatever.

1651 N. Cicero Ave., Cragin Station, Chicago.

THE ILLINOIS FIREBALLS OF JULY 25, 1929

By CHARLES P. OLIVIER.

During the first half of the night of July 25, 1929, several fireballs were seen from a large area of the country, Illinois being in the center. One in particular that passed just west of Chicago, at 9:46 C.S.T., attracted much attention and was the direct cause of this investigation. This was made possible by the prompt action of my colleague, Dr. S. G. Barton, who saw it from the Yerkes Observatory, in company with several members of its staff. Immediately he put notices in leading Chicago and Milwaukee papers asking that observers report to me, and as a consequence over 400 letters were received. Follow-up letters with questionnaires were sent to the more promising of these observers, most of whom aided greatly by filling out and returning them. A quite independent study was undertaken by Prof. C. C. Wylie, who has long since published his conclusions.*

As the writer had never received so many data on one object (as was presumed) an intensive study was made, hoping to get an extremely good solution for heights and orbit. This has dragged on much longer than intended. It was found that most of the observations were too general in statement to be of use, so only those by persons who seemed to have some idea of angular measures and directions finally figured in the solutions. Fortunately several members of the A.M.S. itself reported bright meteors that night, and our general files showed several fireballs, seen from ships at sea, on or about that date. All these are discussed.

Reports from Chicago and vicinity were complicated by the local thunderstorms sweeping over that area. Hence people comparatively near together saw one object and missed the other, for it can be proved that two brilliant fireballs fell near Chicago, one about 9:14 C.S.T., the other and more widely observed one at 9:46. The first was east, the second west of the city. Both were seen by one observer at Coldwater Lake, Michigan.

As the first had fewer observations, this will be now taken up. The solution depends upon 4 Chicago, 2 Milwaukee, and 2 Coldwater Lake, Michigan, observations. There may well be others referring to this object among the numerous observations the times of which cannot be fixed. At Chicago, E. R. Haines sent a fine drawing of the path on a star map, showing how it fell to the east over the lake. The times given are usually vague, but Mr. Haines was able to check up his observations by consultation with two friends who saw it, and his was adopted.

*Popular Astronomy, **37**, 514, 1929.

Local Sidereal Time at End Point		265° 08′
Began at 150.1 km over point	86° 35′ W	41° 50′ N
Ended at 10.0 km over point	86° 43′ W	41° 57′ N
Length of path		142 km
Proj. length of path		20 km
Radiant (A.M.S. No. 2223)	a = 320°	α = 271°.7
	h = 81°.7	δ = +35°.4

This radiant is confirmed by A.M.S. No. 2227, based upon 6 to 7 fireballs, of which three were seen on July 24 or 27, 1929, the others on similar dates in 1930.

As the object appeared so near the zenith no correction for zenith attraction was applied. The orbital motion was direct. There is no uniformity in color estimates, but all agree that it was comparable to the Moon, in brightness. It was visible for 3.35 seconds as a mean of 5 estimates, and left a fine trail. It varied in brightness along its path; some thinking it finally exploded. The path was probably slightly curved, but this could not be allowed for in the computations, which assume it was straight, there being too few data to deal with curvature.

From the several hundred observations that presumably refer to the 9:46 fireball, the solution depends upon the following. At Yerkes Observatory six trained astronomers saw the object moving almost head on towards them. They observed its coördinates with all accuracy possible in this class of work. From seven stations in Wisconsin, north of Yerkes Observatory, and from a few in Illinois far to the south, the path was reported vertical. From these data the azimuth of the plane of motion could be determined with unusual accuracy. Next, from Chicago, 43 estimates of the direction and 36 of the altitude at which it appeared were made; and 29 of the direction and 18 of the altitude at which it ended, by observers who had some idea as to what their data meant. Three observers at Chicago observed it pass below Arcturus, then at a = 84°.9, h = 35°.6, and gave estimates of its altitude on that vertical circle.

The point chosen as that over which it began is based, in addition to those made in Chicago, on about 40 estimates from four states. Its ending point was finally fixed mostly on the testimony of those observers in the immediate neighborhood. It is to be regretted that some in the most critical positions for our purposes did not have clearer ideas as to angular measure. Anyone consulting Prof. Wylie's results will see that his path ends farther south than mine. The explanation is however easy; what he derived was the bursting point, based mostly on observations to the west of the path and many distant therefrom; what we give is the point at which the fragments disappeared, quite a different thing. For the fragments were probably invisible to observers at a great distance. The results are not, therefore, contradictory in this sense.

For the 9:46 C.S.T. fireball the following results were computed, on the basis of what has been said:

Local Sidereal Time at End Point		271° 21′
Began at 221 km over point	88° 11′ W	39° 35′ N
Ended at 11 km over point	88° 31′ W	42° 24′ N
Length of path		377 km
Proj. length of path		313 km
Radiant (A.M.S. No. 2224)	a = 354°.9	uncorrected
	h = 32°.6	uncorrected
Zenith correction		—5°.2
Radiant (corrected)	a = 354°.9	α = 276°.4
	h = 27°.4	δ = —20°.2

The fireball was described by Wm. W. Morgan of the Yerkes Observatory as increasing from 0 magnitude to that of the quarter Moon, then decreasing for 2 seconds to the end. About 5 minutes afterwards a terrific detonation was heard, which may however have been thunder. The path was 2°.5 long, the object moving from east to west and downward. He gave the color as orange-yellow, the duration as 5 seconds, saying that it appeared from behind a cloud. Dr. Joel Stebbins at same place gave the color as greenish, but the tail as red; duration 5 to 6 seconds. He states that it was seen through a cloud. Both observers gave the α and δ of the end points. The four other observers at Yerkes corroborated in general these observations.

Using $\frac{1}{2}(5 + 5.5)$ sec = 5.25 sec as the duration, the observed velocity comes out 72 km/sec. This is too high, due doubtless to the Yerkes observers not seeing the very first part of the path, which was in a hazy or cloudy part of the sky. Also the data from elsewhere indicated that the object was not very bright when it first appeared. We have over 100 estimates of durations by other observers. These range from 0.5 second to 3-4 minutes. Arbitrarily rejecting all over 20 seconds and under 2.5 seconds as being obviously impossible, we have 7.34 seconds as the average of 96 estimates. This gives an observed velocity of 51 km/sec, but frankly we can have little confidence in the result. Parabolic heliocentric velocity has therefore been assumed in deriving the zenith correction. The orbital motion was direct.

Mr. John Hanson of Betterdorf, Iowa, sent in an excellent drawing to scale, which probably describes the changes accurately. When he first saw it due east, it was a dark red body, then for 5 seconds it grew in angular size and brilliancy. For 3 seconds it is next described as "one maze of green white light," with apparent diameter equal to that of the Sun. After this it turned into a dull red streak that zigzagged until it disappeared. This latter phenomenon, to those nearer and also to the side of the path, was better seen as separate fragments traveling along together, but some dying out before others. We may conclude that during the 3± seconds the object was at its brightest it appeared more like a cylinder of almost uniform brightness rather than as a bright head with a very much fainter tail. The long-enduring train which lasts for many minutes after the passage of some fireballs was totally lacking.

Many observers mixed up the colors of this appendage, or of the

moment of greatest light or "explosion," or of the fragments, with that of the meteor proper. It is quite clear from the better records that the object did change color, and the description of Mr. Hanson as to these changes fits the average very well. We may safely conclude that the total light of the object, when at maximum, reached that of the full Moon, at least for stations which were nearest its path. Mr. J. C. Mortensen, principal of the high-school at Princeton, Illinois, states that 2 minutes afterwards he saw a smaller meteor follow the same path. This latter was about equal to Venus in brightness. Several observers report and a few send in drawings showing that the object ended in a shower of red fragments. This means that the original mass was shattered, or perhaps that it consisted of a compact group of separate small masses before entering our atmosphere. This latter hypothesis is possibly supported by the cylindrical shape mentioned above.

As to sound phenomena, there are two kinds reported: the first, like a detonation, followed by rumblings which shook houses; the second, something which was simultaneous with the appearance of the fireball itself. Strangely enough the former was reported only from the Yerkes Observatory, and then from a restricted area in LaSalle and Bureau Counties, Illinois. These stations were: Ladd, (40 miles west) at which it was said that after 5 to 7 minutes a heavy explosion that caused buildings to tremble was heard; Mertola (36 miles west) 3 to 4 minutes after, explosion shook ground according to one observer; rumbling sounds heard, windows rattled, house shook according to another; Princeton (51 miles west) 1 minute later rumbling tremor felt and heard for 2 seconds; Tiskilwa (54 miles west) windows rattled, like thunder, shook house. Two observers in Wisconsin and one in Michigan report hearing the explosion but from the intervals of time given they evidently heard something else. The distances of the various stations mentioned are given in miles west of the path projected on the ground. Out of the 400± observations, these five seem the only ones which are definite as to detonations or rumbling sounds. There are a score or two of observers who report simultaneous "hissing sounds," "popping," "swishing," "sounds like a rocket," etc. As many, if not most, were in large cities, suggestion may account for such reports. Several in fact, though reporting them, were candid enough to say that the sounds were probably imaginary. The writer is not prepared at all to deny the possibility of some such phenomenon, possibly of an electrical nature, but does not feel that the data in this case are at all convincing.

From the low altitude at which the fragments disappeared the chances are large that several meteorites lie undiscovered about 5 miles E.S.E. of Harvard, Illinois, a town in McHenry County.

On July 27, 1929, at 10:10 E.S.T., a fine fireball was seen in Virgina. Three observations were sent in, as well as two more which were from hearsay. The following results were computed:

Local Sidereal Time at End Point		*273° 26′*
Began at 104.8 km over point	78° 18′ W	36° 50′ N
Ended at 4.6 km over point	79° 23′ W	37° 06′ N
Length of path		144 km
Proj. length of path		100 km
Velocity (very uncertain)		*22* km/sec
Radiant (A.M.S. No. *2225*)	uncorrected	a = *287°*
		h = +45°
Zenith correction		−1°
Radiant (corrected)	a = *287°*	α = 319°
	h = +44°	δ = +14°

The three estimates of duration were: one 3-4 sec, one 5-10 sec, the other 8-10 sec, average 6.7 sec. The colors given were white, deep blue, and orange. A pale green train was left. The fireball burst at a very low altitude, so low indeed that fragments probably fell as meteorites. The end point is not fixed with sufficient accuracy to justify a search, but is near the village of Motley in Pittsylvania County, Virginia. The orbital motion was direct. The fireball was reported as pear-shaped and two-thirds the size of the Moon. It was bright enough at Lynchburg to cast a shadow for several seconds. No observer heard any sound whatever. Judge John M. Hart of Roanoke, Virginia, was one of the observers, and it was due to his personal efforts that the others reported their observations.

A search in our records disclosed a large number of other fireballs for the years 1928, 1929, and 1930 between the dates of July 17 and 29. A brief discussion of these will follow. There is little doubt that a more complete search of the records by our regular members would yield more radiants and more bright meteors conforming to the radiants actually deduced in this paper. Fireballs 29-7-20-A, 29-7-20-B, and 29-7-21-A[1] seem to have a common radiant at $\alpha = 267°$, $\delta = -24°$ (uncorrected for zenith attraction). The corrected radiant for the great Illinois fireball, A.M.S. No. 2224, is $\alpha = 276°.4$, $\delta = -20°.2$. When the motion in longitude for 5 days is allowed for and also the errors of observation, there is some reason to believe that these four bodies belonged to the same system. The three fireballs in order were described as: bright, white; brighter than any "star" (i.e. planet probably), green, slow, 3 × Venus in brightness; white, 2 sec duration. Fireballs 29-7-24-H, 28-7-27-M, 30-7-24-A, 30-7-24-C, 29-374-BCD,[2] and 30-363-GR give a radiant at $\alpha = 267°$, $\delta = +30°$, which seems well determined. The fireball, whose radiant No. 2223 is within about 7° of this point, almost surely belongs to the same group, as its radiant can scarcely be determined with a smaller error than 5°.

A very uncertain radiant is possibly indicated by fireballs 28-7-17-W, 28-7-28-A, and 30-7-25-A. The last two intersect at $\alpha = 13°$, $\delta = -1°$, and the first passes this declination circle at $\alpha = 8°$, just about the

[1] These numbers are those on the card index at Flower Observatory, the first three give year, month, and day on which object appeared.

[2] Annual serial numbers of B. C. Darling and G. Ridley.

amount of probable motion in the interval. A. King also finds the radiant of a fine fireball observed in England on 27-7-30 at $\alpha = 302°$, $\delta = -11°$. We have 3 or 4 paths of bright meteors which come near this point and so confirm it.

In addition to observations of single fireballs we have the following from Second Officer J. W. Adams of the Am. *S.S. Hualalai.* On 1930 July 24 between 1:50 and 1:55 A.M., Hawaiian Standard Time, in lat. 21° 01′ N, long. 156° 56′ W, four bright meteors were observed, their paths being given. (They are No. 1930-7-24-A, -B, -C, and -D just mentioned.) On 1930 July 25 between 2:00 and 4:30 A.M., from lat. 21° 02′ N, long. 156° 55′ W and 21° 18′ N and 157° 40′ W, 27 meteors were observed. He says: "These bodies were in the northern heavens bearing between 240° and 70°. They were similar in character, about the size of a second magnitude star; all appeared higher than 30° in altitude, traveled swiftly through about 10° of arc on various headings, and left faint trails visible from 2 to 5 seconds. One exception was . . ." (No. 30-7-25-A on our list.)

On the basis of these data radiants of fireballs were determined as follows:

A.M.S. No.	α	δ	No. of Fireballs
2223	271°.7	+35°.4	1
2224	276.4	−20.2	1
2225	319	+14	1
2226	267	−24	3
2227	267	+30	6-7
2228	305	−12	3-4

The parabolic orbits for the three separate fireballs are:

	L	i	Ω	π	q
2223	32°.5	29°.4	122°.2	330°.6	0.95
2224	32.6	1.6	122.2	352.0	0.84
2225	34.4	51.1	124.1	50.6	0.36

Due to the great number of persons who reported data used in this paper—between 400 and 500—it is not possible to publish the usual list of observers. A general acknowledgment is therefore made which is none the less sincere because each name cannot be mentioned. A reprint of this paper is to be mailed to each contributor in recognition of the valuable assistance so readily given, without which such investigations as this would be quite impossible. We further venture to ask similar observations from anyone who in future is fortunate enough to see a great fireball, such as these.

Flower Observatory of the University of Pennsylvania,
Upper Darby, Pennsylvania, 1931 August 22.

IBN YUNUS' METHOD OF LONGITUDE DETERMINATION

By W. CARL RUFUS.

In the history of Astronomy the name of Ibn Yunus (d. 1009) is usually given brief mention as the author of the Hakimite Tables. This Fatimid mathematician and astronomer worked under the patronage of the Mohammedan rulers of Egypt about the time Cairo was founded and became the new capital and educational center. In the preparation of his celebrated tables, which were named after the ruling caliph, he compiled a record of Arabian observations covering nearly two centuries, supplemented by his own eclipse observations, two solar and one lunar, in 977, 978, and 979. The value of his work is indicated by the fact that it played an important part in establishing the secular acceleration of the moon's mean motion. His tables remained the standard for two centuries, were then revised by the Meraga astronomers, requiring twelve years of labor, and were rechristened the Ilkhanic Tables in honor of the new patron of science. In the revision new observations were utilized, which were made at the magnificent observatory at Meraga with excellent instruments surpassed first by those of Tycho Brahe. Ibn Yunus' mathematical work, especially in trigonometry, was not surpassed, nor equalled in some respects, by Purbach and Regiomontanus, foremost European scientists of the fifteenth century.

Usually little credit is given to the sum total of the astronomical work of the Arabs during the stationary period of science in Europe. According to the prevailing idea their chief service to astronomy was that of preserving the work of their Greek predecessors, especially the Great Syntaxis of Ptolemy, called by them Al Magisti (The Greatest). It is therefore interesting to note that at least in one problem of practical astronomy, the determination of terrestrial longitude, the Arabs surpassed the skill of the Greeks. The difficulty of determining the difference in longitude between two places on the earth's surface with a degree of accuracy required in cartography was not successfully overcome by the Greeks. Ptolemy's Geography, the accepted authority in Europe for many centuries, represented the Mediterranean Sea excessively long. The Arab geographers were able to make a correction by shortening the distance about 17°.

Ibn Yunus' method of longitude determination, by observations on stars at the time of a lunar eclipse, possessed considerable merit and evidently was not used in Europe at a much later date. This seems quite certain as it was not included in Dr. John K. Wright's[1] excellent "Notes on the Knowledge of Latitudes and Longitudes in the Middle Ages." In a private letter Dr. Wright comments as follows: "Of

[1] Isis **5**. 75, 1923.

course the fact that Ibn Yunus' method of finding longitude is not referred to in my article is not infallible evidence that knowledge of this method had not come through to Europe in the Middle Ages. On the other hand I think I would have come across some reference to it had it been widely known." This may justify a brief description of the method in astronomical literature, although a translation and appended outline have appeared in a geographical work.[2] The part from Ibn Yunus was translated by Dr. Schoy into German from an Arab manuscript, *Leiden*, No. 143, p. 80, and then rendered into English by Dr. Wright. The doubly translated passage from Ibn Yunus follows:[3]

"In the determination of the difference in longitude between two places from an eclipse of the moon it is necessary that for the measurement one be equipped with two very accurate instruments which have been tested by two men of learning and experience: for experience in mensuration is of the greatest importance. In case the two men should have little experience, calculate the number of days which still precede the eclipse, then let the two measure some fixed stars (their altitudes) until the eclipse takes place, and in this way they will have acquired some practice. It is also necessary that the two know accurately the place where the earth's shadow enters upon the edge of the moon's disk in order that the gaze may be directed unflinchingly at the place of contact, and thus the measurement of ells serves the understanding of the eclipse. I have already explained when discussing the calculation of eclipses how one recognizes the place of the first contact. And in regard to that which lies between the two moments of this contact and the instant when the eclipse becomes evident, certain of the earlier [astronomers] (predecessors) have said that in the interval between these two moments 1° 49′ of the equator turns and this makes 7 minutes 16 seconds of equivalent time. And the matter stands with me almost as mentioned. And now when each of the two has surely (indubitably) noted the eclipse with his eyes, then let him take the altitudes of several fixed stars. Then let each of them reckon from the momentary place of the star and its latitude its [the star's] distance from the celestial equator and likewise the half of its arc which it traverses over the earth, then the variation (3rd inequality) of the moon,[4] furthermore the right ascension of the degree with which it goes through the nonagesimus (highest point of the ecliptic, middle of the heavens),[5] likewise the right ascen-

[2] Carl Schoy, The Geography of the Moslems of the Middle Ages, Translated and Edited by John K. Wright, The Geographical Review, **14**, 265, 1924.

[3] (): In parentheses in Schoy's manuscript: presumably explanatory words and phrases added by Schoy to elucidate the translation from the original Arabic.

[]: Words or phrases added by J. K. Wright to elucidate the translation from German to English.

[4] In the manuscript as originally submitted by Dr. Schoy instead of "the variation (3rd inequality) of the moon" was the phrase "the difference of culmination (of the passage) of the star(?)." Subsequently in a letter to Dr. Wright, Dr. Schoy suggested the passage be changed so as to stand as given in the text.

[5] The meridian.

sion of the degree which rises with it, and also that part of the arc which has swung above the horizon calculated from the rising to the time of the observation (the Dā'ir). Now add to this arc the right ascension of the degree which rises with it: what results is the right ascension of the rising (star)[6] at exactly this moment. We subtract 90° from it, and in case it [the right ascension] is less than 90° we augment it by 270°: that which then results is the right ascension of the degree of the nonagesimus [local sidereal time]. We take the difference between the former[7] and the latter[7] right ascensions (of the nonagesimus) yielded by each single calculation of the two observers in the two places whose difference in longitude was sought: it is equal to the difference in longitude between the two places."

Ibn Yunus' method of determining the difference in the longitude of two places appears to be sound in theory, simple in practice and fairly accurate in results. It was based upon the determination of the local sidereal time ("the right ascension of the degree of the nonagesimus") at two places, using the first contact of a lunar eclipse to obtain simultaneity. The difference in time is, of course, equal to the longitude difference. In the manuscript Ibn Yunus gives evidence of special ability as a practical astronomer. He emphasizes the importance of using accurate instruments which have been well tested and advocates preliminary practice in observation and reduction. He urges special preparation for observations, *e.g.* the determination beforehand of the place of first contact on the limb of the moon. This facilitates the observation of the exact time of the beginning of the eclipse, which is the crucial point in his method of longitude determination; for the accuracy of the result depends upon the agreement of the two observers regarding this signal of simultaneity. He considers this possibility of observational error and agrees with more ancient authorities that the time between the contact and its first appearance to the observer was equal to 1° 49′ of arc. This may be considered as the maximum observational error due to this cause, altho the practical agreement attained was probably much better.

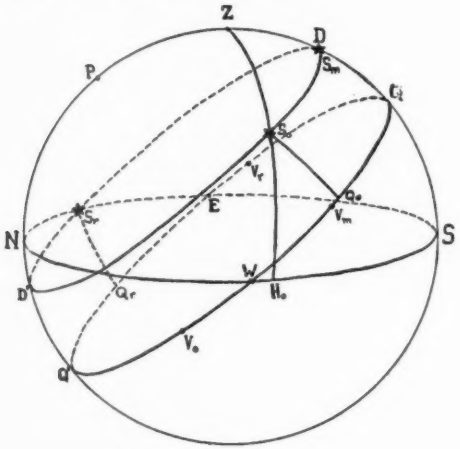
Instructions given to the two observers seem to be quite complete and specific, but difficulties in the manuscript, which were not entirely removed by the translators, leave us in doubt regarding some details. The observational work includes "noting the eclipse" and "taking the altitudes of several fixed stars." Some device for reckoning time was necessary, *e.g.* a clepsydra, or a balance clock may have been available, as its invention is sometimes placed as early as 996 A.D. and attributed to Pope Sylvester II. A cross-staff or triquetrum may have been used to take the altitudes. We assume that the time was also noted when the altitudes were taken, in order that the results might be referrd to the time of first contact.

An evident lapsus in the published translation is the expression, "the

[6] Degree or point on the equator.

[7] Dieser und jener, not former and latter, as the two were simultaneous.

variation (3rd inequality) of the moon," Dr. Schoy's original translation was better:[8] "den Unterschied des Durchgangs (Passage) des Sterns." Another apparent error is the parenthesis (star) in the expression, "the right ascension of the rising (star) at exactly this moment." It is necessary to substitute rising "degree," *i.e.* the rising point of the equator at the time of the observation. This quantity diminished by 90°, (with precaution noted) gives the local sidereal time. The reasons for the suggested changes may readily be seen by the proposed explanation of the accompanying diagram.



EXPLANATION OF DIAGRAM.

The circle represents the celestial meridian.
NESW is the horizon. QQ', the equator.
DD', the diurnal circle of the star.
S_r, S_m, S_o, the star at rising, on the meridian, and at the time of observation.
V_r, V_m, V_o, the vernal equinox at the same instants.
S_r Q_r, portion of star's hour circle at the time of star's rising.
H_o S_o is the altitude of the star.
The star's latitude is not given as the ecliptic is omitted from the diagram.
Q_o S_o, the star's distance from the celestial equator, *i.e.* its declination.
S_r D, half of the arc which the star "traverses over the earth," *i.e.* half its diurnal arc above the horizon.
Q_r E, the equivalent of the questioned expression, "the difference of culmination (of the passage) of the star," which is the difference between the right ascension of the star and the right ascension of the point of the equator which rises with it.
V_m Q, "the right ascension of the degree with which it goes through the nonagesimus," (the meridian). This is the star's right ascension, which is given also by V_r Q_r and by V_o Q_o.
V_r E, "the right ascension of the degree which rises with it."
S_r D S_o, "that part of its arc which has swung above the horizon calculated from the rising to the time of observation." An equivalent arc on the equator is V_r Q V_o.

[8] The difference of the transit (culmination) of the star.

V. Q E, the sum of the two preceding arcs, which is the right ascension of the rising point on the equator at the time of the observation. Hence the suggested correction of Schoy's parenthetical expression, *star*, to our explanation, degree or point on the equator.

V. Q, obtained by taking Q E = 90° from the preceding arc. This is the right ascension of the nonagesimus (the meridian) or local sidereal time expressed in degrees.

PLANET NOTES FOR DECEMBER, 1931

By CLIFFORD E. SMITH.

The *Sun* will be moving from the northern part of Scorpio, across southern Ophiuchus, to the northern part of Sagittarius. Its apparent path in the sky will be in a southeasterly direction until the occasion of the winter solstice at $1^h\,30^m$ P.M., C.S.T., on December 22. Thereafter the apparent motion will be northeast. The position of the sun on the first and last days of the month will be, respectively: R.A. $16^h\,24^m$, Decl. −21° 37′; R.A. $18^h\,36^m$, Decl. −23° 11′.

The phenomena of the *Moon* will occur as follows:

Last Quarter	Dec.	2	at 11 A.M.	C.S.T.
New Moon		9	" 4 A.M.	"
First Quarter		16	" 5 P.M.	"
Full Moon		24	" 5 P.M.	"
Perigee		6	" 12 M.	"
Apogee		18	" 6 A.M.	"

Mercury will be in western Sagittarius during this period. Early in the month it will be an evening star setting about an hour and a half after the sun. Greatest elongation east will occur on December 3. During the middle of the month, however, it will be near the sun in apparent position since inferior conjunction will occur on December 21. At the end of the month it will be in the morning sky rising about an hour and a quarter before the sun. Its brightness at the beginning and at the end of the month will be about magnitude zero. The distance from the earth to Mercury will be about 98 million miles on the first, and this distance will decrease to about 63 million miles on the twenty-first, and increase to about 73 million miles again by the end of the month. The diameter of the apparent disc will vary between six and nine seconds of arc. Conjunction with the moon will occur on the tenth, and conjunction with Mars on the sixteenth. The apparent motion of Mercury will be direct to December 11, and from then to the end of the month it will be retrograde.

Venus will be an evening object of magnitude about minus three in Sagittarius. It will be moving from the western to the eastern part of the constellation. Its distance from the earth will decrease from about 145 million miles to about 132 million miles, and its apparent diameter will increase from about eleven to about twelve seconds of arc. At the beginning of the month Venus will set about an hour and a half after the sun. Conjunction with the moon will occur on the eleventh and conjunction with Saturn on the nineteenth.

Mars will be too near the sun in apparent position to be of interest. At the end of the month it will set about a half hour after the sun.

Jupiter will be a morning object in western Leo of magnitude about minus two. During the middle of the month it will be on the meridian about 4:00 A.M.

Standard Time. Its distance during this period will be about 440 million miles, and its apparent diameter will be about 40 seconds of arc. Jupiter's motion will be direct until the tenth of the month. Conjunction with the moon will occur on the first and twenty-eighth.

Saturn will continue as an evening object in Sagittarius, setting about two hours after the sun during the middle of the month. The apparent diameter of the planet proper will be about fourteen seconds of arc, and its distance from the earth will be about 1000 million miles. Conjunction with the moon will occur on the eleventh and conjunction with Mercury on the nineteenth.

Uranus will be an evening object in southern Pisces. During the middle of the month it will be on the meridian about 7:00 P.M. Its apparent diameter will be about 3½ seconds of arc. Conjunction with the moon will occur December 18.

Neptune will be a morning object in central Leo. During the first part of the month it will rise about midnight since quadrature west will occur on the first. Its apparent diameter will be about 2½ seconds of arc. Conjunction with the moon will occur on December 2 and on December 29.

OCCULTATIONS

OCCULTATIONS VISIBLE IN LONGITUDE +72° 30′, LATITUDE +42° 30′.
(Contributed by the office of the *American Ephemeris*.)

Date 1931	Star	Mag.	IMMERSION Greenwich C.T.	IMMERSION *a*	IMMERSION *b*	IMMERSION Angle E from N	EMERSION Greenwich C.T.	EMERSION *a*	EMERSION *b*	EMERSION Angle E from N
			h m	m	m	°	h m	m	m	°
Dec. 5	g Vir	5.6	8 21.6	−0.5	+1.0	101	9 16.8	−0.3	−0.6	327
14	128 B.Cap	6.5	0 14.0	−1.5	−2.0	106	0 58.9	+0.5	+1.5	190
16	h Aqr	5.4	2 44.6	0.0	+1.2	18	3 34.0	−0.4	−1.9	275
21	66 Ari	6.1	23 40.0	..	..	347	0 1.6	..	..	314
22	χ Tau	5.3	23 18.1	−1.0	+1.4	90	0 23.3	−0.6	+2.3	225
24	107 B.Aur	6.5	8 48.4	+0.5	−3.5	151	9 24.4	−1.3	+0.4	220
25	49 Aur	5.1	8 38.8	..	..	25	8 52.2	..	..	2
25	134 B.Gem	6.5	23 0.1	+0.4	+1.5	74	23 52.9	−0.2	+0.8	286
29	34 Leo	6.4	2 34.8	..	..	195	2 40.8	..	..	206
30	χ Leo	4.6	3 8.0	+0.2	+1.9	77	3 51.8	−0.3	−0.9	335
	OCCULTATIONS VISIBLE IN LONGITUDE +91°, LATITUDE +40°.									
Dec. 3	89 Leo	5.7	13 31.6	−1.1	−1.7	143	14 43.8	−1.4	−1.6	298
13	128 B.Cap	6.5	23 46.3	−1.6	−0.3	75	0 57.1	−0.5	+0.5	216
16	h Aqr	5.4	2 41.3	+0.3	+2.7	0	3 24.0	−1.6	−2.7	284
22	23 Tau	4.3	9 40.4	−0.3	−0.6	66	10 35.8	+0.4	−1.4	280
22	η Tau	3.0	10 22.7	−0.6	+0.7	31	10 57.0	+1.1	−2.5	315
22	χ Tau	5.3	23 5.7	0.0	+1.7	68	0 8.0	−0.4	+1.7	248
25	49 Aur	5.1	7 52.4	−2.0	0.0	76	9 3.1	−0.9	−2.5	308
27	γ Cnc	4.7	13 30.3	+0.2	−1.9	139	14 20.5	0.0	−1.3	272
	OCCULTATIONS VISIBLE IN LONGITUDE +120°, LATITUDE +36°.									
Dec. 6	40 H.Vir	5.1	12 4.2	−0.2	+0.5	112	13 0.8	−0.3	−0.2	312
17	20 Psc	5.6	0 30.7	−3.0	+0.8	93	1 29.5	0.0	+3.2	180
22	17 Tau	3.8	8 42.3	−1.6	+0.5	54	9 52.2	−0.8	−1.9	283
22	23 Tau	4.3	9 29.2	−0.9	−1.9	108	10 33.2	−1.0	+0.1	233
22	η Tau	3.0	10 6.6	−0.8	−0.9	82	11 13.6	−0.3	−1.0	262
22	27 Tau	3.7	10 59.5	−0.1	−1.6	106	11 56.5	−0.3	−0.3	240
22	28 Tau	5.2	10 59.0	−0.4	−1.0	86	12 0.4	0.0	−0.9	260
22	χ Tau	5.3	23 11.2	+0.8	+1.7	41	23 56.4	0.0	+0.8	281
25	49 Aur	5.1	6 49.2	−2.2	+0.2	99	8 17.5	−2.3	+0.2	266
26	c Gem	5.5	12 15.2	−2.0	−0.1	68	13 4.3	+0.3	−3.0	338
30	80 Leo	6.4	15 38.7	−1.1	−1.6	119	16 45.3	−0.6	−2.0	314

The quantities in the columns a and b are given for the purpose of making these predictions useful for any place within 200 miles of the point indicated. The procedure is as follows: Subtract the longitude of the point given from the longitude of the place in question; multiply the result, taking the signs into account, by the quantity under a for the star to be observed; similarly, with the latitude, using b; apply the sum of the products, with its proper sign, to the Greenwich C.T., and obtain the predicted Greenwich Civil Time for the phenomenon at the place of observation. To obtain Eastern Standard Time it is necessary to subtract five hours; Central Standard Time, six hours, etc.

Note on an Occultation of Sigma Scorpii

Judging from clippings recently received, my cablegram concerning σ Scorpii, published on *Harvard Announcement Card*, No. 165, was slightly misinterpreted in its expansion by *Science Service*. I consequently give here a few complementary data.

The observation was a disappearance at the dark limb, 1931 July 25, and was noted in two sharp steps with interval of a trifle less than half a second, somewhat more than half of the light being extinguished in the first step. Señor Dartayet, observing some fifty metres away, noted identical phenomena independently. My object in sending the cablegram was to bring this star to the attention of observers with the interferometer. No claim of priority was intended, for at the Cape Observatory a reappearance in two steps half a second apart was observed on 1860 March 12, and at Washington, 1917 April 10, the reappearance was noted as "gradual."

Using the angles and apparent motion deduced from the elements for prediction, and supposing the limb smooth, an interval of $0^s.45$ in the disappearance corresponds to a separation of $0''.114$ $(P - 63°.9)$ between the components, where P is their position angle as a double star. This separation is far too large for the spectroscopic period of 33 days, being more than double that suggested by Henroteau (*Publications of the Dominion Observatory*, IX, 102) for his hypothetical twelve-year period, which receives additional support in our observations. Inequalities of the moon's limb would of course change the value above deduced, but the separation is in all probability within easy reach of the interferometer, and it should be possible with its help to settle the question of this suspected period.

Observatorio de La Plata, 1931 September 21. BERNARD H. DAWSON.

VARIABLE STARS

Monthly Report of the American Association of Variable Star Observers for September, 1931

We welcome a list of observations by Mr. S. C. Brown of the American College at Beriut, Syria, also a first contribution from J. W. MacQueen of Birmingham, Alabama, and W. C. Stoecker of Webster Groves, Missouri.

After remaining at normal maximum brightness for only 300 days, the peculiar variable S Apodis has again begun a marked drop to minimum, the curve coinciding very closely with the previous drop early in 1928. RY Sagittarii, presumably well on its way up to normal maximum, has in the past few months been subject

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

July 0 = J.D. 2426523; August 0 = J.D. 2426554; September 0 = J.D. 2426585.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
X AND	α CAS	UZ AND	U PER	S PER	X CET
001046	003656	011041	015254	021558	*031401*
562 11.4 Br	562 2.5 Ko	564 14.1 Br	569 9.7 Jo	590 8.7 Jo	572 11.6 L
591 12.3 Jo	569 2.1 Ko	588 13.3 Ma	575 9.0 Jo	590 9.2 Bg	575 11.6 Pt
592 12.5 Br	570 2.3 Ko	592 13.1 Br	585 8.8 Jo	585 10.1 Sz	Y PER
T CET	578 2.3 Ko	S PSC	587 9.0 Mc	593 9.5 Me	032043
001620	583 2.2 Ko	011208	589 9.1 Mc	R CET	556 8.8 Ah
570 6.3 L	U CAS	564 10.2 Br	589 8.7 Jo	*022000*	559 8.8 Ah
T AND	004047	572 10.3 L	590 9.2 Mc	572 11.7 L	569 8.6 Jo
001726	567[14.4 Br	S CAS	591 8.6 Jo	RR PER	571 8.2 Jo
562 13.3 Br	583[13.3 L	011272	592 9.1 Mc	022150	575 8.0 Pt
577 12.6 Br	592 12.9 Br	564[14.5 Br	593 8.8 Pt	564 13.4 Br	585 8.2 Jo
589 11.5 Jo	593 13.2 Pt	568[11.9 Vh	594 9.0 Mc	573 13.9 Br	589 8.3 Jo
591 11.0 Jo	RW AND	577[13.6 Br	599 8.8 Mc	575 13.5 Pt	590 9.6 Mc
592 12.0 Gy	004132	592 13.6 Br	S ARI	581 13.3 L	592 9.4 Mc
593 11.7 Pt	562[13.9 Br	U PSC	015912	U CET	594 9.3 Mc
T CAS	567 12.3 Br	011712	564 14.5 Br	*022813*	599 9.1 Mc
001755	V AND	564 12.5 Br	577[14.0 L	572 11.8 L	R PER
567 12.2 Jo	004435	572 11.9 L	R ARI	575 12.0 Pt	032335
570 12.0 Jo	564 11.0 Br	577 11.6 Br	021024	RR CEP	564 13.7 Br
574 12.0 Jo	583 11.7 L	593 11.3 Pt	564 8.5 Br	022980	573 12.7 Br
577 11.7 Jo	RR AND	RZ PER	572 8.9 L	569[13.7 Br	575 12.3 Pt
582 10.8 Bg	004533	012350	575 9.2 Pt	573[13.7 Br	577 12.3 L
583 11.6 Be	564[13.9 Br	564 10.7 Br	W AND	577[13.7 Br	591 11.0 Pc
583 11.6 L	567 13.1 Br	583 10.8 L	021143a	R TRI	Nov PER
585 11.0 Jo	RV CAS	591 9.8 Pc	559 8.9 Ah	023133	032443
587 11.4 Mc	004746a	592 10.3 Br	564 8.7 Br	556 7.3 Ah	575 13.0 Pt
589 10.6 Mc	564[14.7 Br	R PSC	575 8.9 Pt	559 7.8 Ah	T FOR
589 10.8 Jo	567[14.8 Br	012502	591 9.7 Pc	567 8.0 Ah	*032528*
590 10.3 Mc	592[13.9 Br	564 12.5 Br	592 9.6 Gy	567 7.7 Jo	572 8.7 L
591 10.6 Jo	— CAS	593 9.2 Pt	T PER	568 8.3 Mn	R TAU
592 11.8 Sj	004746b	RU AND	021258	571 7.8 Jo	042209
593 9.8 Mc	593 10.6 Pt	013238	562 8.6 Ah	575 8.0 Pt	575 9.9 Pt
593 11.4 Pt	W CAS	564 11.2 Br	569 8.7 Jo	578 8.8 Mn	W TAU
594 9.7 Mc	004958	581 11.2 L	575 8.4 Pt	585 8.4 Jo	042215
599 9.6 Mc	567 11.3 Jo	592 11.1 Br	585 8.4 Jo	589 8.8 Jo	575 11.6 Pt
R AND	570 11.4 Jo	593 10.8 Pt	590 8.6 Jo	590 9.4 Wd	577 11.7 L
001838	574 11.7 Jo	Y AND	593 8.5 Me	591 9.2 Sf	S TAU
562 13.9 Br	577 12.0 Jo	013338	Z CEP	592 9.3 Gy	042309
593 13.8 Pt	585 12.0 Jo	564 10.5 Br	021281	592 9.2 Ad	575 11.0 Pt
S TUC	589 12.2 Jo	581 11.5 L	569 11.2 Br	W PER	T CAM
001862	591 12.3 Jo	592 13.0 Br	574 11.5 Br	024356	043065
531 9.3 Bl	591 11.3 Pc	593 13.5 Pt	575 11.5 Pt	567 9.9 Jo	564 10.0 Br
545 10.4 Bl	593 12.2 Pt	600[12.4 Md	591 12.1 Pc	575 9.1 Jo	571 9.3 Jo
S CET	U TUC	X CAS	o CET	575 9.2 Pt	575 9.5 Pt
001909	*005475*	014958	*021403*	585 9.2 Jo	577 9.3 L
572 10.7 L	531 12.8 Bl	569 12.0 Jo	559 6.2 Gy	587 9.3 Jo	585 9.0 Jo
591 10.3 Sf	535[12.9 Sl	571 12.0 Jo	571 6.6 Jo	587 10.3 Mc	589 8.6 Jo
593 10.2 Pt	Z CET	571 12.2 Bn	572 7.1 L	589 10.4 Mc	591 8.7 Pc
Y CEP	*010102*	574 11.5 Jo	574 6.7 Jo	590 10.2 Mc	RX TAU
003179	577 13.0 L	577 11.4 Jo	575 6.5 Pt	590 9.8 Me	043208
562 12.0 Br	593 14.0 Pt	585 11.0 Jo	592 7.5 Ad	590 9.5 Mg	575 10.3 Pt
577 12.4 Br	U AND	589 10.9 Jo	592 7.7 Gy	591 9.4 Jo	581 11.4 L
591 12.9 Pc	010940	591 10.8 Jo	S PER	592 10.2 Mc	R RET
α CAS	564[13.8 Br	591 11.8 Bn	021558	594 10.2 Mc	*043263*
003656	567[13.5 Br	593 11.5 Pt	562 9.5 Ah	U ARI	526[12.0 Bl
558 2.2 Oy	592[13.8 Br	600 11.2 Bn	569 8.6 Jo	030514	X CAM
560 2.4 Ko			575 9.8 Pt	565 9.4 Br	043274
561 2.1 Ko			585 8.5 Jo	572 9.6 L	564 8.6 Br

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

J.D.Est.Obs.

X CAM
043274
575 9.6 Pt
577 9.9 L
591 11.0 Pc
597 11.5 GD
R DOR
043562
526 6.0 Bl
544 5.6 Bl
V TAU
044617
575 12.2 Pt
R ORI
045307
581 12.1 L
R LEP
045514
575 7.9 Pt
V ORI
050003
575 10.2 Pt
581 9.8 L
T LEP
050022
575 12.7 Pt
R AUR
050953
564 9.4 Br
575 9.2 Pt
S AUR
052034
575 8.5 Pt
W AUR
052036
545 12.9 L
570 13.6 Br
575 13.0 Pt
S ORI
052404
575 8.5 Pt
T ORI
053005a
564 10.1 L
572 10.1 L
575 10.6 Pt
576 10.5 Pt
588 11.2 Ma
AN ORI
053005t
588 11.9 Ma
S CAM
053068
571 8.8 Jo
575 9.0 Jo
575 8.7 Pt
591 8.6 Pc
592 8.3 Bg

J.D.Est.Obs.

RR TAU
053326
564 10.8 L
570 10.8 L
572 10.4 L
576 10.8 Me
581 10.8 L
RV AUR
053337
575[12.4 Pt
591[12.5 Pc
U AUR
053531
575 11.6 Pt
581 11.8 L
SU TAU
054319
564 10.0 L
570 9.7 L
572 9.6 L
575 10.2 Pt
576 10.3 Pt
576 10.2 Me
577 10.1 Pt
581 9.7 L
584 10.3 Pt
591 9.5 Pc
Z TAU
054615a
564 12.3 L
RU TAU
054615c
564 10.8 L
U ORI
054920a
575 10.5 Pt
V CAM
054974
565 14.4 Br
Z AUR
055353
569 10.1 Pt
570 10.1 Pt
575 9.6 Pt
576 9.8 Pt
577 9.9 Pt
584 10.0 Pt
590 9.5 Mc
592 9.5 Mc
592 10.0 Pt
593 10.0 Pt
594 10.1 Pt
594 9.4 Mc
599 9.8 Mc
R OCT
055686
526 10.8 Bl
535 10.1 Sl
541 10.0 Bl

J.D.Est.Obs.

X AUR
060450
570 8.6 Br
575 8.9 Pt
581 8.5 L
591 9.4 Pc
V AUR
061647
562 9.2 L
AG AUR
062047
562 9.1 L
581 9.2 L
U LYN
063159
570 13.4 Br
NOV PIC
063462
526 8.3 En
S LYN
063558
564 9.4 L
570 9.1 Br
575 9.6 Pt
Y MON
065111
581 9.5 L
R LYN
065355
564 9.3 L
570 9.0 Br
575 9.2 Pt
V CMI
070109
581 9.4 L
R CMI
070310
581 8.8 L
R VOL
070772
526 13.0 En
L$_2$ PUP
071044
535 4.3 Sl
S VOL
073173
526 8.8 Bl
526 9.0 En
541 9.1 Bl
W PUP
074241
526 8.6 Bl
526 8.2 En
544 8.8 Bl
R CHA
082476
526[12.4 En
535[12.6 Sl
544[12.6 Bl

J.D.Est.Obs.

T PYX
090031
526 [s Bl
V UMA
090151
562 10.6 L
592 10.3 Mc
RX UMA
090567
562 11.1 L
RW CAR
091868
526 11.2 Bl
526 11.8 En
535 11.9 En
Y VEL
092551
526[12.4 Bl
526[12.9 En
R CAR
092962
526 6.4 Bl
526 7.2 En
535 6.8 En
541 6.2 Bl
542 6.4 Sl
Y DRA
093178
560 10.2 L
RR HYA
094023
526 10.6 En
L CAR
094262
535 3.5 Sl
Y HYA
094622
526 8.0 En
Z VEL
094953
526[12.8 Bl
526[12.8 En
RR CAR
095458
526 8.0 En
535 7.7 En
RV CAR
095563
526 13.0 Bl
544[13.1 Bl
S CAR
100661
526 6.9 Bl
526 7.0 En
535 6.7 En
541 6.5 Bl
542 6.5 Sl
U UMA
100860
557 6.3 Mn

J.D.Est.Obs.

U UMA
100860
568 6.4 Mn
585 6.2 Mn
Z CAR
101058a
526[12.3 Bl
535[12.6 En
W VEL
101153
526 10.0 Bl
526 9.8 En
535 10.2 En
541 10.2 Bl
RZ CAR
103270
526 11.5 En
535 11.8 En
R UMA
103769
556 7.8 Ah
557 8.3 Mn
558 7.9 Ah
559 7.8 Ah
559 7.9 Gy
567 7.7 Jo
567 7.9 Ah
568 8.0 Mn
570 7.6 Jo
571 7.9 Wd
574 7.5 Jo
577 7.6 Jo
578 7.9 Mn
578 7.6 Sz
580 7.8 Ah
585 7.8 Jo
585 7.8 Wd
587 7.9 Mc
589 7.9 Mc
589 7.9 Jo
590 8.0 Mc
590 8.0 Wd
591 8.2 Jo
591 8.0 Pc
592 8.2 Mc
592 8.3 Gy
593 8.1 Wd
597 8.2 Me
599 8.4 Mc
V HYA
104620
526 6.5 Bl
526 7.4 En
535 7.1 En
541 6.5 Bl
RS HYA
104628
526[13.0 Bl
535[12.5 En

J.D.Est.Obs.

RS CAR
110361
526[12.3 En
RY CAR
111561
526[13.1 Bl
535[13.1 En
RS CEN
111661
526 8.9 Bl
526 9.1 En
535 9.5 En
541 9.9 Bl
X CEN
114441
526 9.3 Bl
526 9.1 En
541 8.3 Bl
W CEN
115058
526 12.5 Bl
526 12.4 En
535 12.6 En
R CRV
121418
535 9.1 Sl
543 8.9 Sl
547 8.6 Sl
T CVN
122532
561 10.1 Hi
572 10.2 Hi
589 10.5 Hi
U CEN
122854
526 8.4 Bl
526 7.9 En
541 8.6 Bl
T UMA
123160
571 12.0 Pt
575 12.0 Jo
577 11.8 Jo
585 11.5 Jo
585 10.9 Wd
589 11.0 Jo
589 10.8 Al
591 10.8 Jo
592 10.8 Gy
593 10.8 Wd
597 10.5 Me
RS UMA
123459
557 9.2 Mn
559 9.6 Gy
567 9.1 Mn
567 8.7 Jo
570 8.6 Jo
571 9.3 Bn
571 9.1 Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

RS UMA
123459
571 9.7 Wd
574 8.6 Jo
577 8.7 Jo
578 9.3 Mn
585 9.5 Wd
585 8.9 Jo
589 9.4 Jo
589 9.7 Al
590 9.7 Pc
591 9.7 Jo
591 9.4 Bn
592 10.0 Gy
593 9.8 Wd
597 10.2 Me
600 10.4 Bn

S UMA
123961
555 7.6 Ah
556 7.6 Ah
557 8.2 Mn
558 7.8 Ah
559 7.6 Ah
559 8.5 Gy
561 7.7 Ah
562 7.7 Ah
567 8.7 Jo
567 8.0 Ah
568 8.3 Mn
570 7.7 Jo
571 8.5 Wd
571 8.0 Pt
574 7.8 Jo
577 8.0 Jo
578 8.3 Mn
580 8.3 Ah
585 8.3 Wd
585 8.0 Jo
585 8.7 Mn
589 8.3 Jo
589 7.9 Al
589 9.2 Mc
590 9.2 Mc
590 8.5 Pc
591 8.4 Jo
592 9.2 Mc
592 8.9 Gy
593 8.7 Wd
594 9.3 Mc
597 8.6 Me
599 9.7 Mc

U VIR
124606
564 8.0 L
564 7.9 Be

U OCT
131283
526 11.5 Bl
529 11.2 En

U OCT
131283
539 11.1 En
544 11.7 Bl

V CVN
131546
567 8.4 Th
570 8.5 GD
572 8.7 Th
580 7.7 GD
583 8.1 GD
589 8.0 GD
590 7.7 GD
595 7.7 GD

R HYA
132422
526 8.9 Bl
528 9.0 En
535 8.6 Sl
539 9.0 En
541 9.5 Bl
543 9.1 Sl

S VIR
132706
528 7.2 En
535 6.7 Sl
539 7.1 En
543 7.2 Sl

RV CEN
133155
526 9.7 Bl
528 9.8 En
539 9.4 En
541 9.0 Bl

T UMI
133273
562 13.9 L
567 13.8 Br
573 14.3 Br

T CEN
133633
526 7.0 Bl
528 6.9 En
535 7.4 Sl
539 7.9 En
541 7.7 Bl
543 7.6 Sl

RT CEN
134236
526 10.1 Bl
528 11.1 En
539 11.0 En
541 10.9 Bl

R CVN
134440
560 11.4 Bs
568 11.9 Bs
571 12.2 Pt

RX CEN
134536
526[12.1 Bl
528[13.1 En
539[13.1 En

T APS
134677
527 11.3 Bl
529 11.7 En
539 12.3 En

Z BOO
140113
562 13.8 L

RU HYA
140528
526 10.0 Bl
528 9.8 En
539 9.0 En
541 8.5 Bl
544 8.3 Bl

R CEN
140959
527 7.7 Bl
528 7.6 En
535 7.2 Sl
539 8.1 En
541 8.3 Bl
543 7.6 Sl
554 9.2 En

U UMI
141567
555 9.7 Hi
558 9.9 Ah
560 9.9 Hi
562 9.9 Ah
567 9.9 Jo
570 10.3 Jo
570 10.5 Hi
571 10.5 Pt
574 10.2 Jo
577 10.3 Jo
578 10.2 Sz
583 10.7 Hi
585 10.4 Jo
588 10.7 Hi
589 10.5 Jo
590 10.5 Pc
590 10.7 Bg
591 10.7 Jo
596 10.8 Hi

S BOO
141954
554 8.4 Th
559 8.0 Gy
560 8.4 Th
562 8.4 Th
562 8.2 L
567 8.8 Th
567 8.6 Jo
570 8.5 Jo

S BOO
141954
571 8.7 Pt
571 9.1 Th
574 8.6 Jo
577 8.8 Jo
580 9.1 Be
580 9.1 L
582 9.5 Th
585 9.3 Jo
586 9.4 Bg
589 9.6 Jo
590 9.9 GD
591 9.7 Jo
591 9.7 Mg
592 9.7 Gy
598 10.1 Bg

V BOO
142539a
555 8.5 Ah
556 8.5 Ah
558 8.6 Ah
559 8.5 Ah
561 8.6 Ah
562 8.5 Ah
562 8.3 Mn
567 8.5 Jo
567 8.5 Ah
568 8.9 Vh
569 8.3 Mn
570 7.9 Jo
571 8.5 Pt
574 8.0 Jo
577 8.0 Jo
580 8.1 Jo
585 8.2 Jo
585 8.7 Mn
585 8.9 Sf
589 8.3 Jo
589 9.0 Mc
590 9.0 Mc
590 8.9 Sf
591 8.4 Jo
591 8.7 Pc
592 9.1 Mc
594 9.2 Mc
595 8.9 Sf
598 8.6 Mc
599 9.3 Mc

R CAM
142584
555 11.2 Hi
560 11.5 Hi
567 11.4 Bs
569 11.1 Br
571 12.0 Hi
574 11.5 Br
574 11.4 Bs
586 12.4 Bg

R BOO
143227
571 9.9 Pt

V LIB
143417
570[13.1 Bs

S LUP
144646a
529 12.5 En
539[12.1 En

Y LUP
145254
527[13.7 Bl
539[13.7 En

S APS
145971
527 10.3 Bl
528 10.7 En
535 10.4 Sl
539 10.8 En
541 10.8 Bl
543 10.8 Sl
544 10.9 Bl
554 10.8 En

RT LIB
150018
570[13.0 Bs

T LIB
150519
564 12.0 Be
564 12.1 L

Y LIB
150605
562 13.3 L

S LIB
151520
564 11.7 L
564 11.7 L
565 12.0 Bs
568 11.5 Vh

S SER
151714
564 12.0 Be
564 12.0 L
583 11.3 Mg
590 10.3 Bg

S CRB
151731
560 10.5 Hl
563 10.3 Bs
570 10.3 Bs
571 11.0 Pt
585 9.9 Mn
591 9.0 Pc
592 9.1 Sf
595 8.9 Sf

RS LIB
151822
527 9.8 Bl
528 10.0 En

RS LIB
151822
539 10.9 En
544 9.9 Bl
554 10.9 En
564 11.5 L
570 11.5 Bs

R NOR
152849
527 12.2 Bl
528 12.0 En
539 12.2 En
544 12.3 Bl

X LIB
153020
527[12.8 Bl

W LIB
153215
527 11.3 Bl
544 11.7 Bl
570[12.5 Bs

S UMI
153378
556 8.6 Ah
559 8.6 Ah
559 8.6 Gy
562 8.7 Ah
568 8.6 Vh
570 8.1 Jo
571 8.7 Pt
574 8.3 Jo
583 8.9 Ko
585 8.6 Jo
585 9.0 Sf
589 8.7 Jo
590 9.1 Sf
592 8.8 Gy
593 9.3 Me
595 9.3 Sf

U LIB
153620a
527[12.9 Bl

T NOR
153654
529[12.8 En
539[12.8 En

Z LIB
154020
527 12.5 Bl

R CRB
154428
539 6.0 Mg
540 6.0 Mg
541 6.0 Mg
542 6.1 Mg
544 6.0 Mg
544 6.1 Sk
545 6.1 Mg
550 5.9 Sk
552 6.5 Si

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R CrB	R CrB	R CrB	RZ Sco	RU Her	SS Her
154428	154428	154428	*155823*	160625	162807
553 6.5 Si	578 5.7 Ko	598 6.0 Mg	529 12.3 En	567 10.8 Br	570 12.0 Bg
555 5.8 Si	580 6.0 Be	600 6.1 Mg	539 12.0 En	569 10.8 Pt	572 11.8 Be
555 6.2 Sk	580 5.7 Ad	X CrB	563 10.1 Mp	572 10.6 Be	572 11.9 L
555 6.1 Ah	580 6.0 L	154536	571 9.7 Pt	572 10.5 L	590 11.8 Bg
556 6.1 Ah	582 6.1 Pt	545 10.8 Mg	Z Sco	583 11.4 Mg	598 11.0 Bg
556 6.1 Mg	583 6.1 Pt	552 10.1 Hi	*160021*	588 11.4 Ma	T Oph
557 6.0 Be	583 6.0 Me	560 9.7 Hi	527 10.1 Bl	588 11.5 Pc	*162815*
558 6.0 Ah	583 5.9 Ko	568 9.3 Bs	529 10.3 En	R Sco	527 11.6 Bl
558 5.8 Si	583 6.0 Sk	569 9.6 Pt	539 10.5 En	*161122a*	544 12.0 Bl
559 6.0 Si	583 5.9 GD	570 9.5 Hi	544 10.0 Bl	527 11.2 Bl	S Oph
559 6.0 Oy	583 6.0 L	573 9.8 L	563 10.0 Mp	529 11.2 En	*162816*
559 6.1 Ah	584 6.1 Pt	579 9.5 Hi	572 9.7 Be	539 11.0 En	527[13.3 Bl
559 6.0 L	584 6.0 Mg	583 9.4 Mg	572 9.7 L	544 10.3 Bl	W Her
560 5.9 Si	584 6.0 Me	583 9.4 Hi	R Her	563 11.4 Bs	163137
560 6.3 Sk	584 6.2 Gy	588 9.4 Hi	160118	568 11.6 Vh	554 8.4 Th
560 6.0 Be	585 6.1 Sz	588 9.4 Ma	559[10.7 Gy	570 11.8 Bs	556 9.0 Hl
561 6.0 Si	585 6.0 Jo	591 9.4 Sf	567[14.2 Br	S Sco	560 8.8 Hl
561 6.0 Ah	585 6.0 Wd	595 9.5 Sf	570[14.0 Br	*161122b*	560 8.4 Th
562 5.8 Si	585 6.0 Be	596 9.6 Hi	U Ser	527 11.9 Bl	562 8.5 Th
562 6.0 Oy	586 6.1 Pt	V CrB	160210	529 12.0 En	567 8.2 Th
562 6.1 Ah	586 6.0 Mg	154639	569 11.2 Pt	539 12.6 En	567 8.4 Br
562 6.0 L	587 5.9 Mc	545 7.8 Mg	585 9.6 Mu	544 12.8 Bl	569 8.5 Pt
564 6.0 L	588 6.1 Pt	554 7.9 Th	588 9.8 Pc	570[11.6 Bs	571 8.3 Jo
564 5.8 Si	588 6.0 Mg	558 8.0 Ah	588 10.1 Ma	W CrB	571 8.3 Th
565 5.8 Si	588 6.1 Pc	559 8.2 Ah	591 9.4 Mu	161138	572 8.6 Hl
565 6.0 Sh	589 6.1 Pt	560 8.3 Hi	598 9.3 Mu	569 9.5 Pt	575 8.4 Jo
566 6.4 Si	589 6.0 Me	560 7.9 Th	X Sco	570 9.7 Br	582 8.4 Th
566 6.0 Be	589 6.0 Mc	562 7.9 Th	*160221a*	571 9.8 Jo	584 8.5 Me
567 5.9 Mn	589 6.0 Jo	563 7.0 Mp	527 11.5 Bl	580 10.2 Md	584 8.6 Hl
567 6.3 Si	589 6.0 GD	567 7.6 Th	544 12.0 Bl	585 10.9 Sz	585 9.1 Sz
567 6.0 Jo	589 6.1 Wd	569 6.8 Pt	572[12.7 L	588 10.3 Pc	585 8.4 Jo
567 6.2 Sk	589 6.1 Sh	570 7.9 Hi	SX Her	591 10.5 Sf	585 8.5 Ef
567 6.1 Pc	590 6.1 Pt	571 7.9 Th	160325	595 10.8 Sf	588 8.7 Pc
568 6.1 Pc	590 6.0 Mg	579 7.9 Hi	569 8.0 Pt	596 10.7 Me	588 8.5 Ma
568 6.2 Pt	590 5.9 Mc	580 7.2 Md	570 8.1 Pt	598 10.8 Md	589 8.5 Jo
568 6.4 Si	590 6.1 Pc	582 7.6 Th	571 8.0 Pt	W Oph	589 8.8 Me
569 6.1 Pc	591 6.1 Pt	583 7.8 Mg	572 8.4 Be	*161607*	590 8.7 Me
569 6.0 Be	591 6.0 Mg	586 7.5 Bg	572 8.4 L	572 13.7 L	590 8.6 Sf
569 6.1 Pt	591 6.0 Jo	588 7.8 Hi	574 8.3 Pt	V Oph	590 8.6 Hl
570 6.1 Pt	591 6.1 Pc	589 8.0 Mc	582 8.4 Pt	*162112*	592 8.8 Me
570 5.7 Ko	591 6.0 Ad	592 7.6 Mc	583 8.4 Pt	554 8.2 Th	595 9.0 Me
570 6.0 GD	592 6.1 Pt	592 7.4 Md	588 8.4 Pt	560 8.2 Th	595 9.0 Sf
571 6.1 Pt	592 6.0 Me	596 7.9 Hi	589 8.4 Pt	569 7.6 Pt	598 9.0 Me
571 6.0 Jo	592 5.9 Mc	597 7.5 Me	590 8.2 Pt	572 7.2 Be	601 9.2 Hl
571 6.1 Wd	592 6.0 Lg	598 7.4 Md	591 8.2 Pt	572 7.2 L	R UMi
572 5.8 Ad	592 6.1 Gy	598 8.1 Bg	592 8.2 Pt	U Her	163172
572 6.0 L	592 6.0 Ad	599 8.3 Mc	593 8.2 Pt	162119	573 9.5 Be
573 6.0 L	592 6.1 Sh	R Lup	594 8.0 Pt	568 11.8 Vh	573 9.6 L
573 6.0 Be	593 6.1 Wd	*154736*	595 8.3 Pt	569 12.0 Pt	575 9.3 Jo
574 6.5 Pt	593 6.1 Pt	529 12.6 En	596 8.3 Pt	588 11.9 Pc	585 9.0 Jo
575 6.1 Pt	594 6.1 Pt	539 12.2 En	596 8.6 Me	589 12.0 Hi	589 9.3 Jo
575 6.0 Jo	594 6.1 Ad	RR Lib	597 8.7 Me	596 11.8 Hi	591 9.5 Jo
575 5.8 Ad	595 6.1 Pt	*155018*	W Sco	Y Sco	592 9.6 Mc
576 6.3 Si	595 6.0 Me	564 9.6 Be	*160519*	*162319*	R Dra
576 6.0 Sk	596 6.1 Pt	564 9.6 L	527[13.4 Bl	535[11.8 Mg	163266
576 6.1 Sh	596 6.2 Mg	Z CrB	RU Her	SS Her	555 7.9 Ah
577 5.8 Ad	597 6.0 Mg	155229	160625	162807	556 7.7 Ah
578 6.1 Sz	597 6.0 Me	545 13.2 Mg	545 10.8 Mg	569 12.0 Pt	557 7.9 Ah

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R DRA	RV HER	RS HER	UY DRA	RY OPH	SV DRA
163266	165631	171723	175458b	181103	183149
559 8.1 Ah	598[14.1 Mg	570 10.8 Hi	600 10.9 Mg	528 7.9 Sl	562 11.0 Br
559 7.5 Gy	RT SCO	571 10.8 Jo	RY HER	535 7.8 Sl	568 10.9 L
561 8.1 Ah	*165636*	577 11.0 Jo	175519	543 7.8 Sl	588 10.4 Ma
562 8.0 Ah	527[14.0 Bl	583 11.4 Hi	559 11.4 L	556 8.2 Ah	RZ HER
566 7.8 Mn	529[13.0 En	585 11.3 Jo	559 11.4 Be	559 8.1 Ah	183225
567 7.7 Mn	R OPH	589 11.4 Jo	563 10.0 Mp	562 8.3 Ah	544[13.4 Mg
569 7.7 Pt	*170215*	589 11.6 Hi	566 10.4 Br	569 9.2 Pt	570[13.4 Br
571 7.8 Jo	568[12.0 Vh	596 11.8 Hi	569 10.2 Pt	580 10.5 Md	584[13.2 Mg
574 7.8 Mn	594 10.8 Ad	600 11.5 Mg	580 9.3 L		X OPH
575 7.7 Jo	RT HER	S OCT	580 9.4 Be	W LYR	183308
585 8.0 Jo	170627	*172486*	588 9.2 Ma	181136	544 7.7 Sk
585 8.3 Wd	539 11.9 Mg	529 9.0 En	601 8.8 Mg	556 8.2 Ah	555 7.7 Sk
588 8.3 Ma	562 10.1 Hi	530 9.2 Bl	V DRA	559 8.4 Ah	556 7.4 Ko
589 8.3 Jo	566 9.6 Br	539 9.2 En	175654	562 8.5 Ah	557 7.8 Mn
590 9.7 Pc	569 9.7 Pt	544 9.8 Bl	563 11.8 Mp	568 8.3 L	558 7.8 Oy
590 8.5 Wd	570 9.8 Hi	RU OPH	566 11.5 Be	569 7.6 Pt	559 7.7 L
591 8.4 Jo	571 9.7 Th	172809	568 11.4 L	570 7.9 Bg	559 7.9 Be
592 8.7 Gy	583 9.3 Hi	539 12.0 Mg	569 11.2 Pt	571 8.1 Jo	560 7.4 Sk
593 8.6 Wd	589 9.2 Hi	566 13.8 Br	R PAV	575 7.9 Jo	567 7.5 Sk
596 8.7 Me	591 9.2 Pc	569 13.2 Pt	*180363*	580 8.2 Ah	567 7.9 Mn
RR OPH	596 9.1 Hi	573 13.7 Br	529 11.8 En	585 8.3 Ah	569 7.7 Pt
161319	598 9.7 Mg	600 13.1 Mg	540 11.4 En	585 8.3 Wd	571 7.7 Jo
529 9.6 En	RW SCO	RT SER	T HER	586 8.3 Bg	572 7.5 Ad
540 9.8 En	*170833*	*173411*	180531	589 8.2 GD	574 8.0 Mn
569 11.5 Pt	528[12.5 Bl	559 12.3 L	556 10.2 Ah	590 8.3 Sf	575 7.8 Jo
573 11.6 Be	529[12.5 En	RU SCO	559 10.6 Ah	590 8.5 Wd	575 7.6 Ad
573 11.7 L	540[12.5 En	*173543*	559 11.1 Gy	593 8.4 Wd	576 7.9 Sk
S HER	α HER	529 11.6 En	562 10.4 Ah	593 8.6 Me	577 7.5 Ad
164715	171114	530 11.3 Bl	563 11.4 Bc	595 8.6 Sf	577 7.7 Jo
556 10.1 Ah	556 3.7 Ko	540 11.0 En	563 11.5 Bf	597 8.8 Al	579 7.9 Jo
559 10.2 Ah	559 3.5 Oy	544 11.0 Bl	564 12.2 Br	598 8.7 Bg	580 7.7 L
562 10.1 Ah	560 3.5 Ko	SV SCO	568 11.4 Vh	598 8.8 Me	580 7.7 Br
569 10.4 Pt	561 3.6 Ko	*174135*	569 11.8 Pt		591 8.4 Me
570 12.5 Jo	562 3.6 Ko	528 10.2 Bl	570 13.0 Br	RV SGR	592 7.6 Ad
590 11.1 Pc	570 3.6 Ko	529 10.4 En	571 12.0 Jo	*182133*	594 7.7 Ad
RS SCO	578 3.5 Ko	540 10.9 En	571 13.0 L	528 11.3 Bl	597 8.3 Me
164844	583 3.6 Ko	544 10.8 Bl	585 12.8 Al	540 12.1 En	RY LYR
527 7.9 Bl	Z OPH	W PAV	589 13.4 Bg	544 12.1 Bl	184134
529 8.0 En	171401	*174162*	597 13.2 Al		562[14.1 Br
539 8.4 En	554 8.4 Th	529 10.1 En	W DRA	SV HER	564[12.5 Mp
544 8.6 Bl	556 9.0 Ah	530 10.0 Bl	180565	182224	565[14.1 Br
RR SCO	559 9.0 Ah	540 10.7 En	565 14.0 Br	564 10.7 Br	567[14.1 Br
165030a	562 8.8 Ah	544 10.3 Bl	567 13.7 Br	568 10.8 L	R SCT
527 9.4 Bl	562 8.7 Th	RS OPH	569 13.0 Pt	569 11.0 Pt	*184205*
528 9.2 Sl	567 8.3 Th	174406	570 13.6 Br	573 11.1 Br	528 5.7 Sl
529 10.4 En	569 8.5 Pt	569 11.0 Pt	571 13.5 L	585 11.7 Al	535 5.7 Sl
535 9.5 Sl	570 8.0 Jo	U ARA	573 12.8 Br	591 12.4 Pc	539 5.6 Mg
540 10.4 En	573 8.2 Jo	*174551*	592 10.7 Gy	597 12.7 Al	543 5.3 Sl
543 10.0 Sl	582 8.3 Th	529 11.0 En	X DRA		544 5.6 Mg
544 10.6 Bl	590 8.9 Hl	540 10.3 En	180666	T SER	544 5.8 Sk
SS OPH	591 8.8 Pc	RT OPH	541[14.1 Br	182306	556 5.8 Mg
165202	593 8.4 Wd	175111	561[14.1 Br	544 10.2 Mg	558 5.7 Mn
569 13.2 Pt	601 9.0 Hl	566 12.3 Br	565[14.1 Br	563 11.0 Mp	558 5.4 Oy
RV HER	RS HER	573 12.6 Br	567[14.1 Br	564 10.9 Bs	559 5.2 Be
165631	171723	T DRA	570[14.1 Br	569 11.2 Pt	559 5.2 L
539 14.5 Mg	539 9.7 Mg	175458a	573[14.1 Br	571 11.0 Bs	562 5.8 Sk
569 14.0 Pt	560 10.3 Hi	600 12.2 Mg	592[14.1 Br	584 12.2 Mg	563 5.5 Bc
570[14.1 Br	569 10.4 Pt				563 5.5 Bf

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

R Sct
184205
565 5.5 Bc
566 5.6 Bc
566 5.5 Bf
567 5.7 Mn
568 5.5 Pc
568 5.9 Vh
568 5.8 Pt
569 5.9 Pt
570 5.8 Pt
570 5.6 Jo
570 5.9 GD
571 5.8 Pt
574 5.8 Pt
574 5.5 Jo
574 5.9 Bg
575 5.8 Pt
576 5.8 Pt
576 5.6 Bc
578 5.8 Mn
580 5.2 L
580 5.3 Be
582 5.2 Pt
583 5.4 Pt
583 5.5 Mg
583 5.8 GD
584 5.4 Pt
584 5.4 Me
585 5.5 Jo
585 5.7 Mn
586 5.3 Pt
586 5.1 Lg
586 5.4 Mg
587 5.7 Mc
587 5.8 GD
588 5.3 Pt
588 6.0 Ma
589 5.4 Pt
589 5.1 Me
589 5.9 Mc
589 5.8 GD
589 5.2 Bg
589 5.3 Wd
590 5.5 Pt
590 5.7 Mc
590 5.2 Me
590 5.3 Pc
590 5.1 Bg
591 5.3 Pt
591 5.4 Mg
591 5.3 Jo
591 5.4 Lg
592 5.4 Pt
592 5.3 Me
592 5.6 Mc
592 5.4 Lg
592 5.2 Bg
593 5.2 Bg
593 5.5 Pt

R Sct
184205
593 5.3 Me
593 5.6 Wd
594 5.4 Pt
594 5.9 Mc
594 5.3 Bg
594 5.2 Pc
595 5.4 Bg
595 5.8 GD
595 5.4 Pt
595 5.6 Mg
596 5.3 Pt
596 5.6 Mg
596 5.4 Bg
597 5.4 Bg
597 5.7 Mg
597 5.4 Me
598 5.4 Bg
599 6.0 Mc
RW Lyr
184243
562[14.2 Br
565[13.4 Br
567[14.2 Br
567 10.6 Jo
569 11.5 Pt
571 10.6 Jo
582 11.5 Pt
585 10.7 Jo
588 11.7 Pt
591 10.8 Jo
596 11.6 Pt
RX Lyr
185032
562[14.1 Br
573[14.5 Br
R Lyr
185243
559 3.8 Oy
562 3.9 Ko
S CrA
185437a
528 11.3 Bl
528 11.7 Sl
535 12.0 Sl
540 12.0 En
543 12.1 Sl
544 11.6 Bl
ST Sgr
185512a
568 12.0 Vh
584 10.4 Mg
κ CrA
185537a
528 13.0 Bl
528 13.5 Sl
535 13.5 Sl

R CrA
185537a
540 12.8 En
544 13.0 Bl
T CrA
185537b
528 13.5 Sl
535 13.5 Sl
544 13.0 Bl
Z Lyr
185634
564 12.6 Br
569 12.5 L
569 12.5 Pt
RT Lyr
185737
562 13.6 Br
565 13.8 Br
569 13.6 L
573 14.0 Br
V Aql
185905
558 7.6 Mn
567 7.6 Mn
578 7.6 Mn
R Aql
190108
557 10.1 Mn
562 9.7 Ah
567 9.5 Mn
569 8.5 Pt
574 9.3 Mn
580 8.6 Ah
588 8.2 Pc
V Lyr
190529a
566 10.3 Br
569 10.0 Pt
592 11.2 Md
598 10.9 Md
RX Sgr
190818
542 12.4 En
RW Sgr
190819a
542 10.8 En
569 11.3 Pt
584 10.3 Mg
TY Aql
190907
569 10.4 Pt
588 10.5 Pc
590 10.9 Pc
X Lyr
190926
569 9.0 Pt
RS Lyr
190933a
564[12.5 Mp
573[14.1 Br

RU Lyr
190941
566[14.0 Br
591[12.5 Pc
U Dra
190967
530[12.4 Bl
562 10.0 Bs
564 9.7 Br
569 9.6 Bs
569 9.0 Pt
573 9.2 L
590 9.7 Sf
595 9.6 Sf
W Aql
191007
590 13.5 Pc
T Sgr
191017
569 12.7 Pt
573 12.2 Bs
590 12.2 Pc
R Sgr
191019
542 11.5 En
566 11.2 Bc
566 11.5 Bf
569 12.6 Pt
590 11.8 Pc
593 11.1 Wd
RY Sgr
191033
526 10.3 Bl
526 10.9 En
528 10.9 Bl
530 11.0 Bl
535 11.0 En
535 11.3 Sl
540 11.0 En
543 11.1 Sl
544 11.1 Bl
554 10.0 En
560 9.6 L
564 9.9 L
564 9.8 Be
566 10.2 Be
566 10.2 L
569 11.2 Pt
571 11.0 Pt
572 10.0 Be
572 9.9 L
574 11.0 Pt
583 12.0 Pt
589 11.7 Pt
590 12.0 Pt
591 11.2 Pt
592 11.5 Pt
593 11.5 Pt
594 11.3 Pt
595 11.5 Pt

RY Sgr
191033
596 11.3 Pt
TY Sgr
191124
530[12.4 Bl
542[12.2 En
S Sgr
191319a
530[12.2 Bl
542[13.0 En
566[12.4 Bc
590 13.0 Pc
Z Sgr
191321
564 12.3 Mp
SW Sgr
191331
530[12.9 Bl
191350
TZ Cyg
569 10.9 Pt
U Lyr
191637
569 8.9 Pt
571 9.5 Jo
577 9.6 Jo
AF Cyg
192745
559 7.7 Ah
562 7.4 Ah
TY Cyg
192928
562 12.8 Br
569 12.8 Pt
571 12.8 L
573 13.4 Br
RT Aql
193311
556 8.9 Ah
559 8.8 Ah
569 9.1 Pt
572 8.8 L
588 9.7 Ma
590 9.7 Pc
R Cyg
193449
559 10.0 Gy
567 9.5 Br
571 9.0 Jo
571 9.2 Wd
572 9.6 Ad
576 8.8 GD
577 8.7 Jo
577 9.4 Ad
584 8.1 Me
585 8.6 Wd
585 7.2 Al
588 7.7 Ma
589 8.7 Bg

R Cyg
193449
589 8.1 Me
589 8.3 Pt
590 8.6 Mc
591 8.9 Ad
591 7.6 Pc
591 7.7 Jo
592 8.2 Me
592 8.5 Mc
592 7.4 Gy
593 8.4 Wd
593 8.0 Al
594 8.7 Ad
597 7.5 GD
599 7.9 Mc
RV Aql
193509
573 14.0 Br
586 14.2 Lg
586 14.3 Mg
589 14.0 Pt
T Pav
193972
530 9.8 Bl
542 10.7 En
544 10.5 Bl
RT Cyg
194048
559 8.4 Ah
562 8.5 Ah
571 8.8 Jo
571 8.9 Wd
577 9.1 Jo
584 9.2 Me
585 9.0 Al
585 9.3 Wd
589 9.7 Me
589 9.3 Pt
591 9.2 Pc
592 9.7 Gy
592 9.6 Me
592 9.6 Mc
592 10.2 Ad
593 9.5 Wd
593 9.3 Al
594 10.5 Ad
599 9.8 Me
TU Cyg
194348
571 9.5 Jo
572 9.6 L
577 9.7 Jo
588 11.2 Ma
589 10.9 Pt
592 11.7 Me
X Aql
194604
566 11.3 Br
570 11.3 Jo

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
X AQL			**χ CYG**			**R CAP**			**RU AQL**			**WX CYG**			**Y DEL**		
194604			194632			*200514*			200812			201437b			203611		
570	11.1	L	594	4.8	Ad	589	10.5	Pt	572	10.3	L	574	10.5	Jo	562	14.0	Br
571	10.2	Th	594	4.8	Wd	591	10.9	Pc	592	12.2	Br	581	10.8	L	564	13.9	L
585	9.2	Sf	595	4.8	Me	**S AQL**			**W CAP**			583	11.0	Md	574	14.0	Br
587	8.8	Mc	595	4.6	Bg	200715a			*200822*			585	9.3	Al	**S DEL**		
589	9.1	Mc	596	4.7	Bg	570	9.5	Jo	530[	12.5	Bl	592	11.4	Md	203816		
589	9.2	Hi	596	4.6	Wd	572	9.1	Vh	589	12.5	Pt	593	10.0	Al	571	11.4	Bs
589	8.8	Pt	596	4.5	Sh	574	9.5	Bg	**Z AQL**			595	10.6	Bg	586	11.3	Bg
590	9.1	Sf	597	4.9	Bg	580	9.6	Bg	*200906*			596	10.6	Bg	586	11.9	Md
590	9.9	Pc	598	4.7	Bg	582	9.6	Bg	569	11.8	Mp	598	10.3	Bg	589	12.1	Pt
590	9.1	Mc	**S PAV**			584	9.6	Bg	589	12.7	Pt	598	11.4	Md	600	11.9	Md
592	9.5	Mc	*194659*			584	9.7	Me	**R SGE**			598	11.1	Me	**V CYG**		
594	9.3	Mc	542	7.0	En	586	9.6	Bg	200916			**V SGE**			203847		
595	9.0	Sf	**RR SGR**			589	9.6	Bg	570	9.3	Jo	201520			573	13.5	L
596	9.0	Hi	*194920*			589	9.6	Pt	**RS CYG**			564	11.5	Br	588	12.5	Ma
χ CYG			530	11.3	Bl	589	9.8	Me	200938			574	11.3	Br	591	12.0	Pc
194632			544	11.8	Bl	590	9.7	Bg	565	8.3	L	586	11.9	Bg	**Y AQR**		
556	8.6	Ah	**RU SGR**			592	9.7	Bg	571	8.7	Jo	**U CYG**			*203905*		
559	8.4	Ah	*195142*			592	9.8	Me	571	8.9	Wd	201647			573	12.3	Jo
562	8.0	Ah	530	6.8	Bl	593	9.8	Bg	572	8.8	Wd	558	10.3	Mn	589	13.5	Pt
562	7.8	Sk	542	7.2	En	594	9.7	Bg	572	8.8	Sh	569	10.1	Mn	591	13.5	Pc
562	7.8	Oy	544	7.0	Bl	595	9.9	Bg	576	8.8	GD	570	9.9	Bg	**T DEL**		
564	7.6	Br	**RR AQL**			596	9.9	Bg	578	8.6	Sh	571	9.7	Wd	204016		
567	7.7	Sk	*195202*			596	10.0	Me	582	8.3	L	571	10.5	Jo	564[	13.9	L
567	7.3	Ah	566[	13.1	Br	597	10.0	Me	585	8.3	Al	585	9.3	Jo	574[	13.9	Br
568	7.5	Si	591	13.5	Mg	598	9.9	Bg	585	8.5	Wd	585	9.1	Wd	592[	14.3	Br
570	7.2	Bg	**NOV CYG**			**RW AQL**			589	8.8	Wd	589	9.2	Pt	**V AQR**		
571	7.0	Jo	195553			200715b			589	8.6	Sh	591	8.8	Jo	204102		
571	7.3	Wd	589[	12.2	Pt	570	9.3	Jo	589	8.2	Pt	592	10.1	Mc	572	8.5	L
572	7.2	Wd	591[	11.6	Me	574	9.1	Bg	591	8.7	Jo	592	9.9	Md	583	8.7	Md
572	7.0	Sh	**RR TEL**			580	9.1	Bg	593	8.2	Al	593	8.8	Bg	589	8.1	Pt
574	6.3	Bg	*195656*			582	9.2	Bg	594	8.8	Wd	593	9.8	Wd	598	8.6	Me
576	5.9	Bg	542[	12.6	En	584	9.1	Bg	594	7.6	Ad	596	8.2	Al	600	8.4	Md
576	6.8	Sk	**Z CYG**			584	9.5	Me	596	8.6	Wd	597	9.5	GD	**W AQR**		
576	6.3	Si	195849			586	9.1	Bg	596	8.2	Me	600	9.6	Md	*204104*		
577	6.0	Jo	569	10.8	Mp	589	9.2	Bg	596	8.5	Sh	**U MIC**			572	10.0	L
580	5.3	Bg	570	10.5	L	589	9.3	Pt	597	8.6	GD	*202240*			**U CAP**		
582	5.3	Bg	573	9.5	Br	589	9.4	Me	**R DEL**			530	10.4	Bl	*204215*		
583	5.5	Sk	589	9.0	Pt	590	9.4	Me	201008			544	10.5	Bl	530	11.8	Bl
584	5.2	Me	592	9.0	Me	590	9.1	Bg	562	12.6	Br	**Z DEL**			545	10.6	Bl
586	5.2	Me	**S TEL**			591	9.3	Me	564	12.2	L	202817			591	12.0	Pc
586	5.1	Bg	*195855*			592	9.4	Me	589	11.7	Bg	564	11.7	Br	**V DEL**		
587	5.0	Bg	542	12.6	En	592	9.3	Bg	589	11.2	Pt	573	12.6	L	204318		
588	4.9	Bg	**SY AQL**			593	9.2	Bg	**RT CAP**			574	12.3	Br	567[	14.6	Br
588	4.6	Ma	200212			594	9.3	Bg	*201121*			589	13.5	Pt	586[	14.4	Lg
589	5.0	Me	562	13.5	Br	595	9.3	Bg	589	6.6	Pt	**ST CYG**			588[	12.2	Ma
589	4.9	Pt	571	13.0	L	595	9.4	Me	**SX CYG**			202954			598[	13.1	Bg
589	4.9	Bg	586	13.0	Lg	596	9.4	Me	201130			564	11.5	L	**T AQR**		
590	4.8	Bg	586	13.5	Mg	596	9.3	Bg	574	13.3	Br	573	12.0	Bg	*204405*		
590	4.9	Me	588	12.5	Pc	597	9.4	Me	589[	13.1	Bg	573	12.1	Br	562	10.8	Mn
590	5.1	Wd	589	13.4	Bg	598	9.3	Me	**RT SGR**			589	12.6	Pt	569	10.9	Mn
591	5.0	Mg	592	12.5	Br	598	9.4	Bg	*201139*			593	12.6	Bg	570	10.4	Jo
591	5.2	Pc	**S CYG**			**R TEL**			530	7.6	Bl	**V VUL**			573	10.2	Jo
592	4.6	Gy	200357			*200747*			544	8.1	Bl	*203226*			585	9.3	Jo
592	4.7	Me	591	13.1	Pc	530	9.3	Bl	**WX CYG**			589	8.6	Pt	589	9.5	Pt
592	5.0	Lg	573	14.4	Br	544	10.1	Bl	201437b			**R MIC**			590	8.9	Me
592	4.8	Bg	589	13.1	Pt	**RU AQL**			564	10.0	L	*203429*			591	8.6	Jo
593	4.6	Bg				200812			570	10.6	Bg	530	9.5	Bl	591	9.0	Pc
594	4.7	Bg				564	10.5	Br	571	10.7	Jo	545	9.4	Bl	594	9.3	Ad

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
T AQR	Z CAP	W CYG	RS PEG	R PEG	Z CAS
204405	*210516*	213244	220714	230110	233956
597 8.6 Me	589 9.1 Pt	559 5.9 Oy	571 10.1 L	589 8.7 Pt	575 13.0 Br
S IND	R EQU	559 6.4 L	583 9.4 Md	590 8.9 Sf	598 14.4 Mg
204954	210812	571 6.3 L	589 8.6 Pt	592 8.7 Gy	TX CEP
530 13.1 Bl	564 10.9 Br	S CEP	597 9.4 Md	595 9.0 Sf	234875
X DEL	564 10.8 L	213678	S GRU	V CAS	563 13.4 Br
205017	574 11.6 Br	567 10.3 Th	*221948*	230759	575 14.2 Br
562 12.7 Br	588 12.3 Ma	572 10.2 Th	539 8.0 En	589 11.2 Pt	RR CAS
564 12.0 L	589 12.2 Pt	580 10.6 Md	RV PEG	589 11.1 Bg	235053
589 9.5 Pt	597 12.9 Md	589 10.0 Pt	222129	W PEG	571[13.1 Bn
595 9.3 Me	T CEP	RU CYG	573 13.6 L	231425	600[12.9 Bn
598 9.0 Me	210868	213753	575 13.5 Br	567 9.6 Jo	V CET
R VUL	557 10.1 Mn	589 8.8 Pt	S LAC	570 9.3 L	*235209*
205923a	559 10.1 Gy	591 9.3 Me	222439	573 9.6 Jo	564 9.2 Br
585 9.9 Jo	562 9.9 Ah	595 9.4 Me	559 8.3 Ah	585 9.2 Al	R CAS
589 9.5 Bg	567 9.5 Jo	RV CYG	562 8.3 Th	589 9.7 Jo	235350
589 9.2 Pt	567 9.7 Mn	213937	567 8.0 Th	591 9.6 Jo	560 9.8 Mn
590 9.6 Jo	568 9.9 Vh	589 6.3 Pt	570 8.0 L	596 10.4 Al	562 10.2 Br
595 9.0 Me	574 9.4 Mn	RR PEG	571 7.9 Th	S PEG	567 9.9 Jo
597 8.9 Me	585 9.2 Wd	214024	582 7.9 Th	231508	568 9.9 Mn
V CAP	585 8.5 Jo	589 11.0 Pt	583 8.0 Md	562 12.6 Br	573 10.0 Jo
210124	589 8.2 Pt	592 11.4 Md	589 8.1 Jo	570 12.9 L	577 10.3 Jo
531 11.8 Bl	590 8.2 Jo	598 11.5 Md	589 9.1 Pt	577 13.1 Br	578 10.0 Mn
545 10.5 Bl	590 8.8 Wd	R GRU	595 8.5 Me	589 12.8 Pt	585 11.0 Wd
592 9.2 Gy	592 8.7 Gy	*214247*	595 8.4 Bg	Z AND	589 10.5 Jo
TW CYG	594 8.6 Wd	531[12.9 Bl	596 8.0 Al	232848	590 11.2 Wd
210129	596 7.9 Al	V PEG	597 9.5 Md	582 10.3 Bg	590 11.5 Bg
564 11.7 Br	RR AQR	215605	R IND	589 10.8 Pt	594 11.3 Wd
564 10.9 L	*210903*	573 13.2 L	*222867*	ST AND	Z PEG
574 12.3 Br	570 11.1 L	577 12.7 Br	531[12.0 Bl	233335	235525
592 12.4 Md	589 10.7 Pt	589 12.5 Pt	R LAC	585 10.7 Al	562 12.1 Br
598 12.4 Md	X PEG	U AQR	223841	589 10.9 Pt	572 12.3 L
X CAP	211614	*215717*	562 9.8 Br	596 9.7 Al	577 12.5 Br
210221	564 9.7 Br	589 13.0 Pt	570 10.3 L	R AQR	589 12.5 Pt
531 11.2 Bl	571 9.0 L	RZ PEG	589 10.9 Pt	*233815*	W CET
545 11.1 Bl	588 9.9 Ma	220133b	RW PEG	568 7.9 Vh	*235715*
X CEP	589 10.1 Pt	571 11.4 L	225914	573 8.9 L	594 7.6 Ad
210382	591 9.0 L	589 11.5 Pt	562 12.2 Br	588 8.2 Ma	Y CAS
569[14.6 Br	T CAP	T PEG	570 12.7 L	589 8.5 Pt	235855
573[13.2 Bs	*211615*	220412	577 13.0 Br	591 8.4 Me	562 13.4 Br
577[13.9 Br	531 12.3 Bl	573 13.2 L	578 11.9 Sz	592 8.5 Ad	575 12.8 Br
592[14.6 Br	S MIC	577 13.6 Br	589 11.4 Jo	Z CAS	577 13.8 L
RS AQR	*212030*	Y PEG	R PEG	233956	SV AND
210504	531 12.1 Bl	220613	230110	562 13.0 Br	235939
564 11.8 L	Y CAP	567[14.5 Br	559 8.2 Gy	573 12.9 L	562 12.8 Br
567 12.7 Br	*212814*	592[13.7 Br	562 8.1 Br		589 13.2 Pt
589 14.0 Pt	531[12.5 Bl		589 8.5 Bg		
591 13.4 Pc					

RAPIDLY VARYING IRREGULAR VARIABLES.

Star J.D.	Est.Obs.	J.D.	Est.Obs.	Star J.D.	Est.Obs.	J.D.	Est.Obs.
005840 RX ANDROMEDAE—				005840 RX ANDROMEDAE—			
6561.9	12.6 Br	6570.8	12.8 Pt	6575.9	12.7 Pt	6591.7	13.3 Pt
6562.9	13.1 Br	6573.8	11.8 Pt	6576.9	13.3 Pt	6591.8	13.7 Br
5664.8	13.6 Br	6573.8	11.2 Br	6577.9	13.3 Br	6592.7	12.9 Bg
6567.9	13.3 Br	6574.7	11.7 Pt	6588.7	11.3 Pt	6592.7	13.5 Pt
6569.7	13.5 Pt	6574.8	12.4 Br	6590.7	12.2 Pt	6592.8	13.4 Br
6569.9	13.7 Br	6575.9	12.6 Br	6590.7	13.0 Bg	6593.7	13.5 Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
005840 RX ANDROMEDAE—						
	6594.7	13.6	Pt	6596.7	13.4	Pt
	6595.7	13.3	Pt	6598.7	13.1	Bg
	6595.7	13.5	Bg			
060547 SS AURIGAE—						
	6562.6	13.0	L	6576.9	12.6	Pt
	6564.6	13.9	L	6577.6	13.9	L
	6565.0	13.9	Br	6578.0	13.8	Br
	6568.6	12.5	L	6581.5	11.5	L
	6569.8	11.0	Pt	6584.9	11.0	Pt
	6570.0	13.8	Br	6591.7	13.0	Pc
	6571.6	13.9	L	6592.7	11.8	Pt
	6572.6	13.0	L	6593.7	11.5	Pt
	6575.9	12.6	Pt	6594.7	11.9	Pt
074922 U GEMINORUM—						
	6572.6	10.2	L			
081473 Z CAMELOPARDALIS—						
	6559.3	11.6	Be	6589.7	12.4	Pt
	6559.3	11.8	L	6589.7	12.5	Bg
	6560.4	12.2	L	6590.7	12.5	Bg
	6562.3	11.4	L	6590.7	12.3	Pt
	6564.4	11.5	L	6591.6	12.0	Me
	6569.7	11.0	Pt	6591.7	11.8	Me
	6570.7	11.2	Bg	6591.7	11.6	Pt
	6571.6	11.5	L	6591.7	11.7	Bg
	6573.4	12.4	L	6591.9	11.4	Me
	6573.4	11.3	Be	6592.6	10.6	Me
	6573.7	12.0	Bg	6592.6	10.7	Bg
	6574.7	11.8	Bg	6592.7	10.6	Bg
	6574.7	11.7	Pt	6592.7	10.8	Pt
	6575.9	11.9	Pt	6593.6	10.5	Me
	6576.7	12.1	Bg	6593.7	10.8	Pt
	6576.8	11.8	Me	6593.7	10.6	Bg
	6576.9	11.8	Pt	6594.7	10.7	Bg
	6580.3	12.7	Be	6594.7	10.8	Pt
	6580.3	12.6	L	6595.6	11.3	Me
	6581.6	12.9	L	6595.7	10.9	Pt
	6583.3	12.8	L	6595.7	11.2	Bg
	6583.3	12.8	Be	6596.6	11.6	Me
	6584.7	12.6	Bg	6596.7	11.2	Pt
	6586.7	13.2	Bg	6596.7	11.5	Bg
	6587.7	13.1	Bg	6598.6	12.3	Bg
	6588.7	12.4	Pt	6598.6	12.0	Me
202946 SX CYGNI—						
	6569.7	9.5	Pt	6586.7	9.6	Bg
	6570.8	9.0	Pt	6587.7	9.7	Bg
	6571.7	9.5	Pt	6588.7	9.6	Pt
	6573.8	9.5	Pt	6589.6	9.6	Bg
	6574.7	9.5	Pt	6589.6	9.6	Me
	6575.9	9.6	Pt	6589.7	9.6	Pt
	6576.9	9.2	Pt	6590.6	9.6	Bg
	6576.9	9.5	Me	6590.6	9.6	Me
	6577.9	9.6	Pt	6590.7	9.6	Pt
	6580.7	8.6	Bg	6591.6	9.5	Me
	6582.7	8.6	Bg	6591.7	9.6	Pt
	6582.7	9.0	Pt	6592.7	9.2	Pt
	6583.7	9.2	Pt	6593.7	9.3	Pt
	6584.7	9.0	Pt	6594.6	8.7	Bg
	6584.7	9.1	Bg	6594.7	9.0	Pt
202946 SX CYGNI—						
	6595.7	9.3	Pt	6596.7	9.0	Pt
	6595.7	8.8	Pt	6598.7	8.9	Bg
213843 SS CYGNI—						
	6539.7	11.2	Mg	6573.8	11.7	Br
	6540.7	11.2	Mg	6573.8	11.7	Pt
	6541.7	11.1	Mg	6574.0	11.7	Br
	6542.7	11.3	Mg	6574.6	12.0	Jo
	6544.6	11.2	Mg	6574.7	11.7	Br
	6545.6	11.6	Mg	6574.7	11.9	Bg
	6546.6	11.9	Mg	6574.7	11.7	Pt
	6548.6	11.6	Mg	6575.8	11.7	Br
	6549.6	11.7	Mg	6575.9	11.6	Pt
	6551.6	11.7	Mg	6576.6	12.0	Bc
	6553.6	11.5	Mg	6576.7	11.9	Bg
	6554.6	11.6	Mg	6576.7	11.6	Mg
	6559.3	11.6	L	6576.8	11.7	Me
	6559.3	11.6	Be	6576.9	11.6	Pt
	6560.4	11.5	L	6577.6	12.0	Jo
	6560.5	12.0	Bc	6577.6	12.2	L
	6562.4	12.0	Ah	6577.9	11.7	Br
	6562.8	11.7	Br	6577.9	11.7	Pt
	6563.5	12.0	Bc	6578.0	11.6	Br
	6563.6	11.9	Bf	6579.0	11.9	Br
	6564.3	11.6	Be	6580.3	11.7	L
	6564.4	11.6	L	6580.3	11.6	Be
	6564.8	11.8	Br	6580.6	11.8	Jo
	6565.6	12.0	Bc	6580.7	11.9	Br
	6565.8	11.8	Br	6580.7	11.9	Bg
	6566.6	12.0	Bf	6581.5	11.9	L
	6566.6	12.0	Bc	6581.8	11.7	Ma
	6566.6	11.5	Mg	6581.8	11.7	Br
	6566.8	11.8	Br	6582.7	11.9	Br
	6567.4	12.0	Ah	6582.7	11.9	Bg
	6567.6	12.0	Jo	6582.7	11.7	Pt
	6567.8	11.7	Br	6583.4	11.6	L
	6568.0	11.8	Br	6583.4	11.7	Be
	6568.6	12.1	L	6583.6	11.9	Mg
	6568.7	11.3	Vh	6583.7	11.9	Ma
	6569.6	12.0	Jo	6583.7	11.7	Md
	6569.7	11.7	Pt	6583.7	11.7	Pt
	6569.9	11.6	Br	6584.6	11.6	Mg
	6570.6	12.0	Jo	6584.7	11.7	Br
	6570.6	12.1	L	6584.7	11.7	Bg
	6570.7	11.7	Bg	6584.7	11.9	Me
	6570.8	12.0	Br	6584.9	11.7	Pt
	6570.8	11.7	Pt	6585.6	12.0	Jo
	6571.6	11.8	Wd	6585.6	11.9	Wd
	6571.6	12.1	L	6586.6	11.6	Me
	6571.7	11.7	Pt	6586.6	11.7	Lg
	6571.8	12.0	Jo	6587.7	11.8	Bg
	6572.4	11.5	L	6588.6	11.6	Mg
	6572.4	11.7	Be	6588.7	11.7	Pt
	6572.6	12.1	L	6588.9	11.7	Ma
	6572.8	11.5	Br	6589.6	12.0	Jo
	6572.9	12.0	Vh	6589.6	11.8	Bg
	6573.6	11.8	Jo	6589.6	11.9	Me
	6573.6	12.0	L	6589.7	11.6	Pt
	6573.7	11.7	Bg	6589.7	11.5	Mg
	6573.7	11.6	Mg	6590.6	12.0	Jo

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1931.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	Star	J.D.	Est.Obs.	J.D.	Est.Obs.
213843 SS CYGNI—					213843 SS CYGNI—				
	6590.6	11.8 Me	6591.9	11.9 Me		6593.7	11.8 Pt	6596.6	12.0 Me
	6590.7	11.7 Me	6592.5	11.3 Sf		6594.5	11.8 Sf	6596.6	11.6 Mg
	6590.7	11.7 Pt	6592.6	11.7 Pc		6594.6	11.9 Bg	6596.7	11.7 Pt
	6590.7	11.9 Pc	6592.6	11.5 Bg		6594.6	11.9 Pc	6597.6	11.6 Al
	6590.7	11.9 Bg	6592.6	11.7 Me		6594.7	11.8 Pt	6597.6	11.5 Mg
	6590.8	11.6 Mg	6592.7	11.0 Pt		6594.7	11.6 Mg	6598.6	11.6 Mg
	6591.6	11.9 Pc	6592.7	11.5 Mg		6595.5	11.6 Sf	6598.6	11.8 Me
	6591.6	11.8 Me	6592.7	11.6 Br		6595.6	11.2 Bg	6598.7	11.9 Me
	6591.6	11.9 Mg	6592.7	11.5 Lg		6595.6	11.8 Me	5499.6	12.0 Bg
	6591.7	12.0 Pt	6593.5	11.4 Sf		6595.7	11.6 Pt	6599.6	12.0 Mg
	6591.7	12.0 Bg	6593.6	11.5 Bg		6595.7	11.6 Mg	6600.6	12.0 Mg
	6591.8	11.8 Br	6593.6	11.9 Me		6596.6	11.6 Al	6600.8	12.1 Mg
	6591.8	12.0 Jo	6593.7	11.9 Pc		6596.6	11.6 Bg	6601.6	12.0 Mg

SUMMARY OF OBSERVATIONS, SEPTEMBER, 1931.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Ahnert	Ah	28	83	MacQueen	Mu	1	3
Aldwell	Ad	10	24	Marsh	Ma	21	23
Allen, P. R.	Al	15	23	McLeod	Mc	17	62
Baldwin	Bl	79	133	Meek	Me	40	109
Benini	Be	20	37	Mennella	Mn	17	45
Brocchi	Br	104	198	Millard	Md	15	28
Brown, A. N.	Bn	3	8	Monnig	Mg	29	91
Brown, S. C.	Bs	16	22	O'Byrne	Oy	8	9
Buckstaff, E.	Bf	4	6	Peltier	Pt	162	310
Buckstaff, R.N.	Bc	5	16	Proctor	Pc	50	61
Bunting	Bg	33	135	Shinkfield	Sl	18	37
Ensor	En	73	119	Shultz	Sz	7	8
Godfrey Club	GD	9	22	Simpson	Si	2	16
Gregory	Gy	21	32	Smith, L.	Sh	3	10
Hildom, A.	Hi	10	38	Smith, F. W.	Sf	13	30
Hildom, L.	Hl	3	9	Stearns	Sj	1	1
Jones	Jo	56	204	Stoecker	Sk	4	18
Kohman	Ko	6	20	Theile	Th	10	34
Lacchini	L	133	187	Vorhies	Vh	14	15
Logan	Lg	5	8	Webb	Wd	19	55
MacPherson	Mp	10	10				
				Totals		41	366	2299

to very marked fluctuations in light. R Coronae Borealis, at maximum for more than six years, is still bright and should be closely watched in order to detect at the earliest possible moment any tendency to decrease appreciably in magnitude. The interval between the rises of the last two maxima of SS Cygni, Nos. 254-255, was at least of 100 days duration; the longest ever recorded in the thirty-five years that the star has been under observation. This variable was under observation every day between June 7 and September 19, inclusive, a total of 433 observations having been reported in this 105 day interval.

LEON CAMPBELL, Recording Secretary.

October 10, 1931.

COMET NOTES

By G. VAN BIESBROECK.

COMET 1931 *d* (PERIODIC NEUJMIN). As mentioned last month in a post scriptum to the notes on p. 489 this periodic comet was luckily recovered by Dr. Seth B. Nicholson at the Mount Wilson Observatory. His efforts had failed earlier but on a plate taken September 17 with the 100-inch Hooker telescope the tiny moving object was at last detected, after which it was also located on a plate taken August 20 with the large reflector. Since then further plates have been secured both at Mount Wilson and with the 24-inch reflector of the Yerkes Observatory and the identity of the object has been fully confirmed. The orbit given by the writer in *Astronomical Journal*, **40**, 77 (1930) appears to be quite close except that the time of perihelion should be about 1931 April 29.75 U.T. instead of May 8.96. The 17-year period is therefore nine days shorter than was anticipated from the 1913 apparition.

Dr. Nicholson gave the brightness as 15^M for September 17 in his telegraphic announcement. This is probably somewhat overestimated. The plates taken by the writer in the middle of October show the comet as a little star not brighter than the 17th magnitude. The discoverer also mentions that even a one-hour exposure with the Hooker telescope does not reveal the presence of any nebulosity around the star-like nucleus. If it were not for the previous history of this object there would not be anything to distinguish its appearance from that of an ordinary asteroid. However when we recall the circumstances of the apparition in 1913 the absence of visible nebulosity ought not to cause much surprise. The comet was observed then near perihelion and the brightness of the nucleus was estimated as 11^M. In E. E. Barnard's words (*Astr. Nachr.*, **196**, 181, 1913) the nucleus "was so clear cut and distinctly star-like that one would not for a moment have suspected any actual connection with the faint nebulosity apparently attached to it south following. I have not before seen such a striking case of a comet being essentially all nucleus." The nebulosity was then so faint that several observers recorded their inability to see it. This fall the conditions of visibility are much less favorable. Perihelion was passed six months ago and the distance from the earth is nearly four times larger. The nucleus appears five magnitudes fainter than it did in 1913. What was then a faint nebulosity might well be now below the limit of the largest instruments. Not until the next favorable apparition will it be possible to ascertain if the emission of the material forming the eccentric coma has ceased.

The brightness of the object is now slowly decreasing and powerful instruments only can record it. An ephemeris will be found in *Harvard Announcement Card* 182, showing that this minute comet is now crossing the densest part of the Milky Way in Auriga.

In the evening sky COMET 1931 *b* (NAGATA) is still well observable. In the course of October it has shown a most unusual outburst of activity; at the end of September the total brightness was estimated by the writer as 11^M; by October 5 it had dropped to 12 or 13^M but what a surprise on October 10: it was again as bright as in August, fully 8^M as is illustrated by Figure 1 where the comet is seen passing near the star BD 6°3000, magnitude 8.2. The original plate taken with the 24-inch reflector (exposure 15 min.) shows clearly a tail extending over 15′ length in position angle 40° nearly opposite to the direction of the sun and

another broader tail about equally long in position angle 110°; the space between the two tails is largely filled with nebulous material. According to an observation on October 6 by M. Chofardet at Besançon (France) the brightening had already started on that evening. On October 12 the comet was still bright but on October 17 it had dropped to 9^M, and when last observed here on October 21 it

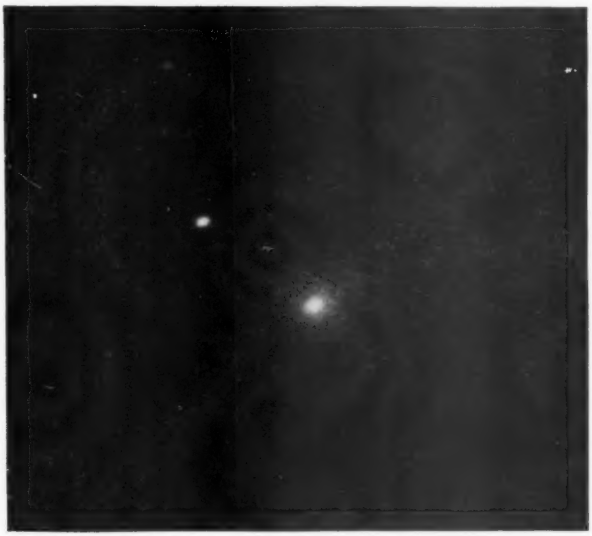


FIGURE 1.

was difficult to see it on the sky illuminated by the moon showing that it was around 10^M. This outburst of brightness is a very unusual phenomenon for a comet which is four months past perihelion. It will be interesting to watch its further development. The following ephemeris continued from p. 487 rests on the same elements by C. H. Smiley; the ephemeris required a correction of +20 sec and —0'2 on October 21.

EPHEMERIS OF COMET NAGATA.

1931 0^h U.T.		α h m	δ ° ′	Distance — From Sun	Distance — From Earth
Nov.	6	15 55.5	+5 35	2.44	3.27
	10	16 3.1	31		
	14	10.6	28		
	18	18.0	28	2.58	3.42
	22	25.2	29		
	26	32.2	31		
	30	39.2	35	2.72	3.56
Dec.	4	45.9	41		
	8	52.6	48		
	12	16 59.1	5 57	2.86	3.68
	16	17 5.5	6 8		
	20	11.7	20		
	24	17.7	34	3.00	3.78
	28	17 23.8	+6 49		

It will be seen that the motion which is almost all in right ascension will carry the comet from the constellation of Serpens into that of Hercules and that conjunction with the sun comes on December 6, when the comet will be 29° north of the sun. The increasing distances make it probable that the brightness will drop farther, barring more unexpected fluctuations.

As anticipated COMET 1931 *c* (RYVES) has now been reobserved in the morning sky. When first recorded on October 9 by the writer it appeared as a very diffuse coma some 3′ or 4′ in diameter with no definite nucleus but a central condensation. The total brightness had faded from naked eye visibility in August to about that of a 9^M star on October 9. As the region moved away from the sun from day to day the comet was gradually seen better. On several photographs taken here with the 24-inch reflector later in the month there appears a tail three-quarters of a degree in length in position angle 120° which, instead of being in a direction opposite to that of the sun, is almost *in that direction!* Short tails and jets are frequently encountered emanating in the direction of the sun but it is a very unusual feature that the main tail would be so oriented.

It appears now that the preliminary orbit by Bower and Miss Miller (see p. 488) gave a close prediction of the position after the conjunction with the sun. The ephemeris deduced from these elements is continued here until November 19 when the comet will presumably be quite faint:

EPHEMERIS OF COMET RYVES (From Copenhagen Circular 339).

1931	α	δ	Distance	
0^h U.T.	h m	° ′	From Sun	From Earth
Nov. 3	10 53.2	+1 24	1.78	2.14
7	52.0	21		
11	50.5	20		
15	48.6	21		
19	10 46.3	+1 24	2.06	2.11

The correction of the ephemeris was -0^m4 and +9′ in the middle of October, much smaller than that of a later ephemeris issued by the Berkeley computer and depending on a slightly hyperbolic orbit. The October observations confirm the small perihelion distance at which the comet must have passed on August 25.

Williams Bay, Wisconsin, October 23, 1931.

METEOR NOTES

By CHARLES P. OLIVIER.

Last month the condensed results of 143 sets of observations were published. This time we endeavor to give the results communicated from 43 stations manned by volunteers, which appear in Table I, and the results of our regular A.M.S. members in Table II. In both groups it frequently happened that several persons assisted, but the work is primarily credited to the person reporting, with notes as to the others. Many of the observers in Table I gave details of their observations, and most of them the rate for each half hour or hour during the whole period. The observers in Table II did not generally count, but mapped all, or nearly all, the meteors seen. Hence in such cases their rates should be far below those of a person under similar conditions who counted only and did not use up time in mapping. If one counted only, the fact is stated.

Many radiants can undoubtedly be deduced from the meteors mapped, but the task of projecting them has not yet been carried out. The radiants and a general study of the density of the stream will have to appear later.

We have a unique and interesting report from C. B. Ford and B. C. Darling relative to telescopic meteors. Mr. Ford writes that the idea originated with his colleague, but that the observations were made with his 1¾-inch finder, with a 5°± field. The record follows:

Date	Began	Ended	Total	Meteors	Fac.	Rate	Obs.
1931 Aug. 10	12:43	13:55	72	10	1.0	7.2	C.B.F.
Aug. 11	11:07	11:12	5	1	1.0	...	C.B.F.
Aug. 12	11:44	11:54	10	2	1.0	...	C.B.F.
	11:55	12:00	5	1	0.9	...	B.C.D.
	12:43	12:53	10	2	0.9	...	B.C.D.
Aug. 13	12:35	14:00	85	6	1.0	4.8	B.C.D.
Aug. 15	12:07	12:37	30	0	...	...	C.B.F.
Total			187	22			

Out of these 22, 5 were brighter than sixth magnitude and 17 were from seventh to tenth magnitude. Traces had been made from B.D. charts, and 21 meteors were plotted thereon. The writer has projected these paths. On August 10, the projections of 3 meteors intersect very closely at $\alpha = 40°.9$, $\delta = 54°.4$ (1875); the other five telescopic meteors go entirely away from this point. On August 13, 5 out of the 6 go from north to south, perhaps indicating a radiant in the same general position.

This being Mr. Ford's first serious attempt at such work, the important point to be noted is his excellent success in seeing so many telescopic meteors. Plotting these upon a field of faint stars, for the first time, would be difficult in any case. Therefore it is quite possible that further experiments by the same observers would yield somewhat sharper limits. Nevertheless Öpik, in 1921, found a considerable dispersion of telescopic Perseids, so this is to be expected. We extend to Mr. Ford and Mr. Darling hearty congratulations on carring out successfully a program which so often fails.

We wish to welcome the following new members into the American Meteor Society:

J. H. Campbell, 815 Seventeenth Street, Greeley, Colorado.
P. H. Reedy, 1600 College Avenue, Terre Haute, Indiana.
R. T. Merkel, Box 381, Topton, Pennsylvania.
F. K. Volz, 2001 Surf Avenue, Belmar, New Jersey.
Miss M. E. Moore, Baylor Station, Belton, Texas.
Miss M. J. Carmen, 3600 Chicago Avenue, Minneapolis, Minnesota.
Miss M. L. Jewett, R. 1, Box 3, Grandview, Tennessee.
R. W. Miller, Landsdowne, Pennsylvania.
R. T. Hampton, 1182 Washington Blvd., Baltimore, Maryland.
James Stokley, Franklin Institute, Philadelphia, Pennsylvania.
H. A. Burrus, 479 Quincy Street, Brooklyn, New York.
J. H. Hett, 17 Oriole Avenue, Bronxville, New York.
J. J. Hayes, 1148 E. First Street, Salt Lake City, Utah.
J. B. Witherspoon, Drawer 320, Weatherford, Texas.
E. D. Wilson, Apt. L, Marlborough, Everett, Washington.
E. R. Reich, 108 N. Hinman Avenue, Marshfield, Wisconsin.
J. D. Williams, 23 Philadelphia Avenue, Tunkhannock, Pennsylvania.
R. S. Tilgner, Sanator, South Dakota.

PROBATIONAL MEMBERS.

Alvan Baker, Hillside School, Marlboro, Massachusetts.
Day Gee, 1817 Bond Avenue, East St. Louis, Missouri.

Attention should be called to the approaching maximum of the Leonids. We have hopes for a good shower, which may occur on the nights of November 16-17 or 17-18. Some Leonids should certainly be seen at at least three days earlier and one or two later than these dates. We trust that the A.M.S. members will be ready for whatever comes.

TABLE I.

No.	Observer and Station	1931 Aug.	Began	Ended	Total Min.	Meteors	Fac.
165	Loveless, Mrs. J. L., Chandler, Arizona	11	9:10	13:00	240	107	1.0
166	Thompson, C. W., Santa Cruz, California	11	12:05	12:35	30	19	0.8
		11	12:50	13:20	30	28	0.8
167	Lewis, F. H., San Jose, California	12	10:45	11:30	45	27	...
169	Long, G. A., Belleville, Illinois	11-12					
170	Willman, D. W., Bloomington, Illinois	11	12:30	13:45	75	241	...
171	Wade, Mrs. L., Pekin, Illinois	11	9:30	10:45	75	28	...
		12	9:00	10:00	60	33	...
172	Grant, W .T., Kewanee, Illinois	11	10:10	14:05	217	681	0.8
173	Guthrie, W. H., Moline, Illinois	11	11:10	13:10	120	155	...
174	Cully, J., & Firestein, R., South Bend, Ill.	11	10:30	11:20	50	11±	1.0
		12	10:20	11:25	65	38	1.0
175	Spriestersbach, Miss E., Charlestown, Ind.	11	12:00	13:00	60	20	...
177	Roof, E. A., Hutchinson, Kansas	11	10:00	11:00	60	15	0.8
		12	10:00	11:30	90	20	0.8
178	Lawton, H., New Orleans, Louisiana	11	12:30	14:15	105	14	...
178a	Flanagan & Skinner, New Orleans, La.	11	12:00	13:40	100	59	...
		12	12:00	13:30	90	37	...
179	Delcroix, Miss D., New Orleans, Louisiana	11	12:00	12:27	27	30	...
180	Cooper, M. M., New Orleans, Louisiana	11	14:00	14:45	45	7	...
		12	11:45	14:00	75	10	0.3
181	Austin, Miss M., Jackson, Louisiana	11	9:00	11:00	120	50—	...
		12	8:30	12:00	210	117	...
182	Persons, W. J., Kalamazoo, Michigan	11	14:40	15:50	70	116	1.0
		12	14:30	15:30	60	98	1.0
183	Reynolds, E. E., Kalamazoo, Michigan	12				87	...
184	Gardner, Miss V., Menominee, Michigan	11	10:39	13:00	141	54	0.9
		12	10:30	14:00	210	108	...
185	Hard, R., Coopersville, Michigan	11	12:30	13:15	45	70	1.0
186	Ross, Mrs. F. S., Birmingham, Michigan	11	10:00	11:30	90	3	...
		12	11:35	12:30	55	3	...
187	Hervington, B. M., Jackson, Michigan	11	12:00	12:30	30	34	0.5
189	Deitz, A., St. Paul, Minnesota	11	10:00	16:00	360	228	...
190	Sucker, K. L., Minneapolis, Minnesota	11	12:00	12:57	57	12	1.0
168	Chambers, H. F., St. Louis, Missouri	11	9:30	16:00	390	67	1.0
		12	9:30	?	?	19	0.4
191	Stowers, L. M., Fair Grove, Missouri	?	12:00	14:00	120	36	0.9
192	Spencer, H. L., St. Louis, Missouri	11?	12:15	16:40	230	175	1.0
193	Hart, G., Freeman, Missouri	11	10:00	12:00	120	21	0.9
194	Flynt, Miss M., California, Missouri	12	13:00	14:30	60	107	1.0
195	Haferkamp, W. C., Augusta, Missouri	11	12:00	14:30	150	75	...
196	Zartman, M. M., Havre, Montana	13	9:30	9:45	15	6	...
197	Smith, Mrs. G. O., Lincoln, Nebraska	11	12:00	14:00	120	50	0.8
198	Dundon, W. J., Wahpeton, North Dakota	11	10:00	12:00	120	33	...
199	Chicchis, R. D., & Norris, Mrs. G. R. Norman, Oklahoma	11	11:45	12:15	30	29	...
200	Duggan, Miss C., Kingfisher, Oklahoma	11	11:30	13:30	120	102	1.0
201	Caskey, R. L., Ponco City, Oklahoma	7	9:00	10:00	60	25	...
202	Gibson, W. B., Port Kewandin, Ontario	11	12:15	13:15	60	35	0.6
		12	9:15	10:05	50	28	0.8
		12	10:05	10:45	40	30	0.8

No.	Observer and Station	1931 Aug.	Began	Ended	Total Min.	Meteors	Fac.
208	Bullock, Emerson W., Brampton, Ontario	11	10:58	14:00	238	30	0.2
		11	14:	16:00	?	..	0.8
		11	16:00	17:30	90	79	0.8
		12	10:53	12:32	99	17	0.7
		12	13:51	15:43	112	58	0.8
		14	9:45?	14:15	270?	52	...
203	Tilgner, S. R., Sanator, South Dakota	11	8:30	10:00	90	4	...
207	Kent, J. T., Jackson, Tennessee	11	11:25	13:25	120	190	1.0
		12	11:42	14:03	141	177	...
204	Stout, A., Clarksburg, West Virginia	11	11:50	13:20	90	68	0.9
205	Eggert, Mrs. G., Merrill, Wisconsin	12	9:45	13:15	210	161	1.0
206	Perrin, C. N., Sanborn, Wisconsin	11	11:30	13:00	90	63	1.0

The following notes are associated with the preceding table as indicated by the reference numbers.

No.	Notes
165	Even distribution.
166b	Two observers.
169	5 plotted. Saw 10 in 10 sec. on August 12 at 12h.
170	4 observers. Even distribution.
171a	Two observers.
171b	Two observers.
172	A group of observers. More rapid rate after 12h.
173	Five obs. facing diff. directions.
174a	Two observers.
174b	Two observers.
177b	"Or more."
178a	Two observers.
178b	Two observers.
180b	Increasing cloudiness from 13h.
181a	"We."
181b	"We."
182a	2 obs. in different directions.
182b	2 obs. in different directions.
183	Two observers.
184b	Two earlier.
186a	Cloudy skies at end of observing time both nights. Partial count?
189	Rate generally increasing.
190	Partial count; bright meteors only.
168a	Partial count: excludes those around Lyra.
168b	Partial count, as on Aug. 11.
192	Maximum rate between 14:15 and 14:45.
197	Even distribution.
199	Two observers.
200	Three observers. Max. rate 12:00 to 12:30.
201	Group of observers.
202c	"With friends."
208a	Three observers.
208b	Two observers.
208d	Stopped by clouds.
208e	Clouds by 15:21.
208f	Two observers.
203ab	Intermittent observations.
207a	Very even distribution. 2 obs.
207b	Very even distribution. 2 obs.
204	Five obs. Even distribution.
205	Rather even distribution.
206	Rather even distribution.

TABLE II.

OBSERVATIONS AT PERSEID MAXIMUM BY A.M.S. MEMBERS.

CARLTON ABERNATHY, CLEARWATER, FLORIDA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate
Aug. 5	9:25	9:45	20	3	0.9	9.0	10
8	9:40	10:20	40	4	0.5	6.0	12.0
9	9:10	9:30	20	6	0.9	18.0	20.0
11	9:20	9:40	20	5	0.3	15.0	..
12	8:50	9:51	61	12	0.9	11.8	13.1
13	9:15	9:35	20	2	0.5	6.0	12
16	8:40	9:40	60	8	0.9	8.0	8.9

RICHARD G. CLARKE, FRANKLIN. PENNSYLVANIA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate
Aug. 13	13:00	15:15	135	50	1.0	22.2	22.2

MRS. HELEN M. EDWARDS, FAIRHOPE, ALABAMA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate	Notes
Aug. 11	12:00	16:00	240	298	1.0	74.5	74.5	66 bright.*
12	12:00	16:00	240	297	1.0	74.2	74.2	52 bright.*

*Counts.

FRED L. TROYER, TORONTO, CANADA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate	Notes
Aug. 11	11:49	16:00	214	80	0.9	...	....	(*)
12	11:37	12:20	43	15	0.9	...	....	(*)

*These plotted; 185± others seen.

W .P. WARNER, F. G. FENDER, ST. GEORGE, SOUTH CAROLINA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate		Notes
Aug. 12	13:15	14:15	60	83	1.0	...	....	62	Peresids.

GORDEN RIDLEY, ALAMEDA, CALIFORNIA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate		Notes
Aug. 12	10:35	16:25	350	136	0.8	23.3	29.1	25	brilliant.
15	9:51	16:16	385	132	1.0	20.6	20.6		
17	12:51	15:06	135	56	1.0	24.9	24.9		

GEORGE C. CLARIDGE, REEDSBURG, MICHIGAN.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate
Aug. 16	9:30	10:30	60	10	0.7	10.0	14.3

PROF. H. H. NININGER, R. NININGER, DENVER, COLORADO.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate		Notes
Aug. 11	14:00	15:15	75	177	1.0	...	....	151	Perseids
12	14:00	15:15	75	119	1.0	...	....	105	Perseids

FRANKLIN F. MARSH, FREDERICK, MARYLAND.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate
Aug. 13	12:30	13:00	30	6	0.2	12.0	??

J. W. MACQUEEN, BIRMINGHAM, ALABAMA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate	Notes
Aug. 5	10:00	11:00	60	4	0.7	4.0	5.7	C.S.T.
9	9:15	11:15	120	14	0.9	7.0	7.8	C.S.T.
11	9:45	12:00	135	34	0.9	15.1	16.8	C.S.T.

MILT MEHL, HOLLISTER, MISSOURI.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate
Aug. 10	8:55	10:00	65	10	1.0	9.2	9.2
11	8:15	9:15	60	10	1.0	10.0	10.0
12	8:30	10:30	120	30	1.0	15.0	15.0
13	8:30	9:35	65	7	0.7	6.5	9.3

FRANKLIN W. SMITH, GLENOLDEN, PENNSYLVANIA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate
Aug. 6	8:20	9:20	60	2	0.9	2.0	2.2
17	8:20	9:05	45	4	0.9	5.3	5.9

THOMAS K. TOMPKINS, NORTH HILLS, PENNSYLVANIA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate
Aug. 7	11:26	13:23	117	4	0.9	2.1	2.3
15	11:05	13:27	142	7	0.9	3.0	3.3

MISS M. E. TRIMMIER, CHICAGO, ILLINOIS.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate		Notes
Aug. 11	9:50	14:20	270	32	0.6	7.1	11.8	29	Perseids.
12	10:45	15:00	255	70	0.9	16.5	18.3	61	Perseids.
13	11:30	14:30	180	20	0.9	6.7	7.6	13	Perseids.

SALLY URQUHART, NORWELL, MICHIGAN.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate
Aug. 11	10:00	12:10	130	19	0.8	8.8	11.0

RAYMOND H. WILSON, JR., DUNCANNON, PENNSYLVANIA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate	Notes
Aug. 16	9:00	9:50	50	11	1.0	...	....	2 Per. 2 obs.

BALFOUR S. WHITNEY, NORMAN, OKLAHOMA.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate	Notes
Aug. 12	12:00	13:30	90	106	...	70.7	...	83 Per. count

STUART L. O'BYRNE, WEBSTER GROVES, MISSOURI.*

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate	Notes
Aug. 11	10:10	16:00	455**	463	1.0	61.0	61.0	Count.
12	8:26	9:25	59	17	...	17.3	....	Count.
14	8:39	10:00	81	8	...	5.9	....	Count.
Aug. 10	8:36	10:30	114	7	0.8	3.7	....	Plotted.
11	11:33	14:59	193	57	1.0	17.7	....	Plotted.
11	14:08	15:32	84	51	...	36.4	....	Plotted.

*The observations reported by S. O'Byrne were made by 7 members, including himself, of the Webster Groves Nature-Study Society. The observers were Miss I. Schnaedelbach, C. Simpson, A. E. Mueller and Mrs. Mueller, William Stoecker and C. Benke. Their observations show a sharp maximum at 15^h C.S.T. on night of August 11-12.

**Totals of simultaneous observations by different observers.

MICHIGAN GROUP.

CLINTON B. FORD, ANN ARBOR, MICHIGAN.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate	Notes
Aug. 4	11:59	12:17	18	2	0.7	...	....	Intermittent.
10	9:40	10:00	20	4	0.9	...	....	Intermittent.
10	11:53	13:24	91	5	0.8	...	....	Intermittent.
10	13:25	14:53	81	9	0.8	6.6	8.0	
12	10:15	12:05	110	19	0.8	10.4	13.0	
12	10:00	10:45	45	27	0.9	36.0	40.0	(1)
12	10:20	12:10	110	71	0.8	39.7	48.4	(2)
13	12:40	14:08	88	11	1.0	...	....	(3)
13	14:10	15:10	60	28	1.0	28.0	28.0	17 plotted.
15	11:03	12:03	60	10	0.9	10.0	11.1	1 later.

(1) Count by S. A. Bush. (2) Count by V. Slocum. (3) Intermittent; Seven others seen.

B. C. DARLING, ANN ARBOR, MICHIGAN.

1931	Began	Ended	Total	Meteors	Fac.	Rate	Cor.Rate	Notes
Aug. 10	12:12	14:12	120	39	0.8	19.5	24.4	32 plotted.
11	11:04	11:21	17	2	0.4	...	....	very poor sky
12	10:05	11:05	60	19	0.9	19.0	21.0	1 more seen
12	11:05	12:05	60	17	0.8	...	....	Intermittent

Flower Observatory, Upper Darby, Pennsylvania, 1931 October 13.

Counts of the 1931 Perseids

In some previous years Columbia College and the University of Iowa attempted simultaneous observations of meteors. These observations were not as successful as had been anticipated. Clouds occasionally prevented observations at one station when the other was plotting. The long base line and the inaccuracies in plots by inexperienced observers made these chartings of little value excepting

for the arousing of interest and for practice computations. This year, it was therefore decided to confine our efforts to counts of the meteors. Plans were made for systematic counts at three stations in and near Dubuque, the record being kept by 15-minute intervals, and all groups under the personal direction of Columbia College students. Observations were made from the night of Saturday, August 8, to Thursday, August 13, inclusive. The following is a summary of the results, the times being in noon-to-noon reckoning.

1931	Observer	Began	Ended	Minutes	Meteors
Aug. 8	A	11:50	14:30	160	26
8	C	11:30	15:00	210	88
9	A	11:35	15:15	220	114
9	B	12:00	15:00	180	111
9	C	11:30	14:15	165	105
10	A	12:45	15:15	150	85*
11	A	11:40	15:30	230	560
11	B	12:00	15:15	195	544
12	A	11:45	15:30	225	565
12	B	12:00	15:15	195	603
13	A	12:00	14:00	120	126*

*Clouds interfering.

The observers in Group A were Melvin Petry, Melvin Doran, and Gordon Saunders, at Eagle Point Park, Dubuque. The observers in Group B were Joseph Palen, Harold Baker, Charles Moser, Fred Jecklin, Dale Brown, Francis Becker, and Herbert Lashway, observing at Camp Burton, 12 miles northwest of Dubuque. The Group C observers were Alvin Jaeger and younger brother, at Bunker Hill, Dubuque, Iowa.

J. A. Theobald.

Observations of Two Fireballs

The first fireball was observed on the evening of September 9. It was of magnitude —5 and appeared suddenly in the constellation of Sagittarius near the planet Saturn. It ended near the southern horizon. Its motion was very swift, and its color blue white, like that of a class B star. The time was about 8:15 P.M., Central Standard Time.

The second fireball was observed at 9:00 P.M., C.S.T., September 14. I was observing variable stars with my 3-inch refractor. I saw a fireball appear near λ Aquarii, and move slowly across the sky to a position about 3 degrees south of ι Ceti, where it vanished. The color was an orange red, it fluctuated considerably in brightness, but at its brightest, in the middle of its path, it was comparable in brightness to the moon when four days old, and lit up the landscape noticeably. It left only a very faint train and had a diameter, when brightest, of about eight minutes. The time it took in its flight was about ten seconds. It is my impression that I saw the path nearly end on.

Noah W. McLeod.

Christine, North Dakota, September 16, 1931.

The 1931 Perseids

The 1931 Perseid meteors were observed at Iowa City by C. C. Wylie, C. J. Lapp of the Physics Department, and a number of students. Students were divided into two groups, and on the night of the 11th, meteors were charted from two stations 20 miles apart. Observations were made August 8 to August 12 inclu-

sive. The observations of duplicate meteors have been used for student computations of the paths of meteors through the atmosphere, but is planned to use a longer base line and three stations in November, if possible.

At Dubuque, systematic counts were made by three groups under the direction of Father J. A. Theobald of Columbia College. Observations were made on the nights of August 8 to August 13 inclusive. At Sioux City, observations were made on two nights by Professor Ira Gwinn of Morningside College, and two students. A few other observations were also reported. The most complete count was maintained at Dubuque, which indicates the rate was highest during the fifteen minute period 15:00-15:15 August 12, or at about 3:00 A.M. on the morning of August 13 civil time.

The summary of the Dubuque observations is given separately, and certain miscellaneous observations will be included in a later report. The counts reported by Professor Gwinn from Sioux City, Iowa, follow. The times are noon-to-noon reckoning.

1931	Observer	Began	Ended	Minutes	Meteors	Leaving train
Aug. 11	A	11:20	11:40	20	11	..
11	A	11:40	12:00	20	22	..
11	A	12:00	12:30	30	12	..
11	B	16:00	16:30	30	18	2
11	B	16:30	16:55	25	6*	2
12	B	14:40	15:00	20	21	4
12	B	15:00	15:30	30	39	13
12	B	15:30	16:00	30	28	11
12	B	16:00	16:30	30	27	9
12	C	14:30	15:00	30	23	5
12	C	15:00	15:30	30	29	11
12	C	15:30	16:00	30	30	11
12	C	16:00	16:30	30	22	9

Observer A—Miss Grace Smith and her mother.
Observer B—Professor Ira Gwinn on Morningside College campus, with a very open field of view.
Observer C—Mr. Doane, a Morningside student, working independently near Professor Gwinn.
Observers A, B, and C all of Sioux City, Iowa.

*Dawn interfering.

C. C. WYLIE.

University of Iowa, October 20, 1931.

NOTES FROM AMATEURS

Blind Astronomy

After many experiments with television apparatus I have come to the conclusion that hearing the light of stars is possible. This may seem very absurd, but by an electric circuit it is very simple.

The apparatus consists of a photo-cell in the focus of a lens (telescope objective) with a disc with a .01-inch hole in the center to receive the light of a single star. This light when entering the cell is turned into a minute electric current in the usual way, and is amplified by many stages of amplification and a pair of headphones is put at the output. Thus stars will be heard as clicks. The louder the click the brighter the star. With a super-hetrodyne as an amplifier

giving an amplification of from 500,000,000 to 1,000,000,000 times the cell generation, I think 32nd magnitude stars could be detected.

The cluster in Hercules sounds like heavy static, whereas the spiral of Andromeda sounds like a more condensed faint static with louder clicks every once in a while.

This would be good for variable star work because of its accuracy with a galvanometer.

Planets are very faint because an eyepiece must be used which cuts down the light too much.

I have also considered the idea of projection of a telescopic field on a screen. This idea would be very good if the present scanning systems were more perfect. Just at present they are very crude and would give such poor definition that it would be useless.

The method would be to scan a telescopic field with a disc photo-cell, amplify the received current and feed a neon tube with it, and scan this in synchronism with the other disc. The light resulting would be thrown on a slightly frosted glass screen. This could be seen by many people at one time and would be good for illustrating lectures and so forth.

WILLIAM S. VON ARX.

573 Monroe Street, Brooklyn, N. Y.

First Annual Assembly of Amateur Astronomers and Telescope Makers*

Receiving inspiration from a visit to the Springfield Amateurs' convention in the fall of 1930, the Astronomical Section of the Academy of Science and Art of Pittsburgh, early in the summer of 1931, decided to conduct a similar event in this city, so that amateurs in adjacent states could enjoy contact with others of kindred interest, discuss problems and experiences common to all, and exchange information.

To this end, preparations for the first assembly were begun early in April this year. Lists of prospective attendants were secured from various sources, being compiled mainly from publications such as POPULAR ASTRONOMY, the *Scientific American* and the *Monthly Evening Sky Map*. Back issues of these magazines were consulted and all names appearing during the past two years were noted. In this manner about 250 names were secured.

A program of activities was outlined and, through the courtesy of Mr. Dravo, Pittsburgh amateur, about 500 copies of this schedule were printed. A coupon to be returned by interested parties was provided at the bottom of the schedule, which declared the intention of the mailer to attend the sessions. In this manner a close approximation of the number of out-of-town visitors was secured.

Early in July, a publicity campaign was inaugurated in the Pittsburgh papers, the first article of which covered a concentration of amateurs' telescopes at the Allegheny Observatory for the observation of sunspots. About a dozen instruments were assembled and photographs of them appeared in the leading papers the following Sunday, together with a descriptive article. In this manner, each week carried a story of our activity. Official notice of the coming event was published in amateur astronomical journals, and served to interest a large number whom we were unable to reach otherwise.

*Conducted by the Astronomical Section of the Academy of Science and Art of Pittsburgh, covering the mid-Atlantic States, Saturday and Sunday, August 8-9, 1931.

During the week of August 3, an elaborate display was set up in a prominent Pittsburgh bank, and a display of an amateur's telescope, as well as a dozen pictures of others of similar nature, was placed on exhibit in Pittsburgh's leading hotel. The latter exhibit was made and arranged by Bob Marshall, photographer of the Pittsburgh group.

Early Friday evening the out-of-town guests began to arrive. Leading all was Mr. James Stokley, Director of the Fels Planetarium of the Benjamin Franklin Memorial Institute of Philadelphia, who arrived in the plane Orion, a favorable astronomical omen. A committe of reception greeted Mr. Stokley at the airport, and escorted him to the headquarters hotel. The majority of visitors arrived Saturday morning, some by auto, train, bus, afoot, and bicycle. In all over a hundred were registered and ready for the program at 2:00 P. M. that day.

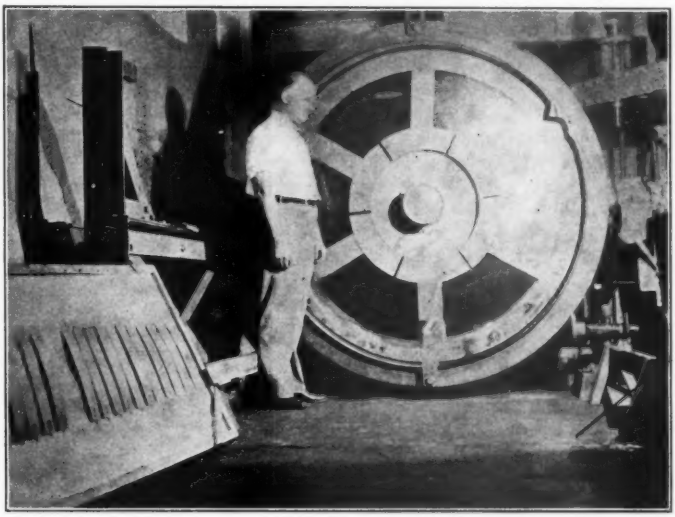


FIGURE 1. THE 69-INCH CASSEGRAIN MIRROR.

Delegates upon registering were given an identification tab bearing a gold star and, if they were using an auto, a large golden star was placed on the rear window of their car for identification by traffic officers. A banner was draped over the hood for similar purposes. Through Mr. Paul Byrnes, convention manager of the Chamber of Commerce, arrangements were made with the Traffic Division of the Police Department to clear certain sections of the streets adjacent to the hotel so that delegates could park their cars unmolested until the formation of the parade.

On schedule, the line-up of machines was formed in front of the hotel, and all delegates placed for transportation to the shops of J. W. Fecker, successor to John A. Brashear. Motorcycle officers escorted the machines through the downtown traffic, along gaily bedecked streets, lined with throngs of people who cheered vigorously. Closely following the machines was a large brass band,

back of which marched columns of soldiers of the 80th Blue Ridge Division. This latter corps gave the clue to the decoration of the streets and the cheering multitudes, for unwittingly we were preceding their parade by just a few blocks, and both visitors and natives were under the impression the machnies, bearing the gold stars on the back windows, contained the Gold Star mothers and fathers of the soldiers of the 80th Division, an amusing mistake.

Upon arriving at the shops of Mr. Fecker, the delegates were shown the 69-inch Cassegrain mirror, now completed, for the Perkins Observatory of Ohio Wesleyan University. It was resting under test conditions, which included a 36-inch silvered flat mirror, the largest by far that many of the visitors had ever seen.

Also on display here were the huge grinding and polishing machines capable of handling these large discs, precision instruments of all kinds and sizes, telescopes of various apertures but all of one quality, the best; spectroscopes for direct vision and range finding instruments, as well as telescopic sights for rifles, occupied part of the display. Many amateurs availed themselves of Mr. Fecker's generosity in securing information upon various problems of a technical nature that they had faced during the year.

About 4:30 the crowd adjourned to the Allegheny Observatory where a tour of the building was made. Visitors saw here the world's finest photographic refractor, figured by Brashear, in the shops they had just left. The clear aperture of the instruments is 30 inches. There is a correcting lens available for visual use but the instrument has rarely been used in this manner, its entire service being used in parallax and photometric measurements of high precision. Dr. Jordan, the director of the Observatory, and the associate director, Dr. Keivin Burns, were both absent from the city, so the tour was conducted by Mr. Roe, who is assistant lecturer on the staff.

The Keeler 30-inch Cassegrain reflector, named for the former director who found spectroscopic evidence of the true nature of the rings of Saturn, was inspected, and in the hollow pier of this instrument, 20 feet below ground level, the crypt in which rest the ashes of John Brashear and his beloved wife, Phoebe, was respectfully entered.

Also seen here were the machine shops in which accessories for the various instruments are made, the computing rooms, the storage rooms for the thousands of parallax plates taken in past years, many of them yet unmeasured, spectrograph room, photographic dark rooms, transit house and library.

At 6:00 P.M., a supper was served in a nearby church. Mr. Roe, chairman of the Pittsburgh group, acted as toastmaster, and introduced as first speaker Mr. John W. Cunningham, President of the Academy of Science and Art of Pittsburgh, who welcomed the delegates. Mr. John M. Pierce, President of the Telescope Makers of Springfield, outlined the beginning of Telescope Making activity in this country, and asserted that they were proud of the progress of their offspring, the Pittsburgh group. Mr. Pierce warned those present of the danger of any innocent by-stander at any amateur activity being infected with the telescope-making bacillus, announcing that it was no longer man's last resource, as there were two ladies present at the Springfield convention a few weeks previous, who had aroused considerable envy amongst the opposite sex, due to the excellent quality of thir telescopic mirrors.

Mr. Meyran D. Blish, Secretary of the Amateur Telescope Makers of Chicago, a recent organization, outlined the development of the amateurs in that city,

and extended the invitation of Professor Philip Fox of the Adler Planetarium to all present to visit them whenever possible, and to consider Chicago as the location for the next Assembly.

Mr. Leo. J. Scanlon, Secretary of the Astronomical Section of the Academy of Science and Art of Pittsburgh, read a telegram from Professor Leon Campbell of Harvard, informing the group of the sudden indisposition of Professor Campbell, who had been scheduled to speak on "The Lure of Variable Star Observing." Letters of congratulation were received from Professor Fox, Professor Keivin Burns, Wm. Tyler Olcott, and Secretary Croston of the recently organized Amateur Telescope Makers of Tacoma, Washington. Mr. Scanlon gave a summary of the convention registrations, in which it was disclosed that the largest delegation came from Reading, Pennsylvania, near Philadelphia, having six attendants; Chicago and Springfield, Vermont, tied for second place, each having had five delegates present. Other cities represented included Plainfield, New Jersey; Glen Campbell, Philadelphia, Allentown, Warren, New Castle, Elizabeth, Brownsville, Beaver Falls, and Washington, in Pennsylvania; Canton, Dayton, Bellville, Columbus, and Crestline, Ohio; Buffalo and Brooklyn, New York, and Washington, D. C. Mr. Russel W. Porter of California held the distinction of having traveled the greatest distance.

Mr. J. W. Fecker, our host of the afternoon, voiced his opinion of the Amateurs in Pittsburgh, and extended the invitation that amateurs continue to call upon him and submit their work for test and criticism and suggestion. A vote of thanks was given Mr. Fecker for the courtesy extended the amateurs in their visit that day.

Mr. J. E. Willis, Astronomer at the Naval Observatory at Washington, D. C., outlined the work in progress there, and explained the method of ascertaining the correct time, and the manner of broadcasting it throughout the nation. Mr. Willis spoke of the plans for a 40-inch reflector to be made by Ritchey according to curves calculated by him, the glass to be obtained from the St. Gobain factory. Mr. Willis stressed the importance of observing lunar occultations and the great opportunity for amateurs to coöperate in this work.

Professor Zaccheus Daniel of the Allegheny Observatory, discoverer of the comet Daniel in 1907, told us of the method he used in finding this object and several others since. Professor Daniel emphasized the opportunity for amateurs with meagre equipment in the field of cometary discovery, naming as the chief requisites persistency and thoroughness, and a low power glass that has a field about 2° in diameter.

Russel W. Porter of the California Institute of Technology gave a summary of the work completed on the 200-inch telescope to be erected in the southwest. Mr. Porter stated that in all there would be required 13 mirrors, from two to sixteen feet in diameter, for use in different combinations to produce different focal lengths. The largest disc of quartz to be cast up to this time is five feet in diameter. He stated that practically all the technical difficulties in the way of casting a larger disc had been overcome.

Mr. Porter stated that the machine shops at Pasadena, where all the small parts and accessories to be used with the new giant telescope are to be made, have been completed and are ready for work. A second building is the astrophysics laboratory, which will also house the astronomers. It will contain the offices, laboratories, and a vertical solar telescope, extending a hundred feet below the

ground level, to be used for photographic and visual observations.

The location for the 200-inch telescope is as yet undecided; the final decision will be delayed as long as possible in order that as many observations may be made at the three favored sites as is possible. The three sites that present the best seeing at this time are, first, at Palomar, about 125 miles south of Pasadena, at an elevation of 6000 feet. The second is in the San Gabriel Mountains, back of Pasadena. This location straddles the San Andreas fault, which, however, does not seem to worry the astronomers. The third location is on Mint Canyon, at the edge of the Mojave desert.

As is customary at Mount Wilson, the astronomers will not live at the observatory, but in the building before named, and will visit the observatory at regular periods for work and then return.

Mr. Porter gave some dimensions of the proposed telescope. The main mirror will be about sixteen feet in diameter, the tube housing it will be twenty-four feet outside dimension, and sixty-five feet long. It will weigh about 115 tons with the mirrors. The mounting, to be built at some place as yet undecided, will weigh about 500 tons; it will be of the yoke type, with the roller bearings on the polar axis unrelieved. Mr. Porter announced his connection with the new Griffin Planetarium to be erected in Los Angeles in the near future, but jokingly stated they "would probably wait until the one in Philadelphia was built, and then make theirs a foot larger." This with a smiling glance at Mr. Stokley, future director of the Fels Planetarium in Philadelphia.

Mr. James Stokley expressed great satisfaction with the progress of amateur astronomy in America, and compared conditions existing here and those in England. Mr. Stokley mentioned briefly the plan of the Philadelphia Planetarium, which is to be a part of the section devoted to Astronomy in the Franklin Institute. The main feature of this memorial building will be the Franklin Rotunda, around which will be the various exhibit halls of the different arts and sciences, including physics, engineering, and astronomy. At present, only about forty per cent of the entire project will be completed, and that by the year 1933. The Planetarium will be open by the fall of 1932.

Mr. Roe, the toastmaster, then introduced Mr. William R. Ludewig, Lecturer at the Allegheny Observatory, who was to be our host during the course of the evening, and at Mr. Ludewig's direction, the assembly adjourned to the lecture hall of the Observatory. As one of the very few present who was well acquainted with "Uncle" John Brashear, Mr. Ludewig delivered a touching address upon his life and his work, outlining his progress from an obscure amateur, not unlike any of those present, to the pinnacle of his chosen profession. Mr. Ludewig spoke of Brashear as a man and a friend to all who knew him, and his words will long be remembered by us who heard him.

Immediately after this address, Pittsburgh's youngest amateur astronomer and telescope maker, Master Jordan Bihler, aged 10, respectfully placed a memorial wreath at the foot of the life-size bronze statue of John Brashear, located in the entrance hall of the Observatory.

The evening was devoted to observations of the sky with the 13-inch refractor and several home made instruments, as well as a 4-inch triplet refractor loaned by Mr. Fecker for the occasion. Many an amateur experienced a new sensation as he gazed through the 13-inch refractor at Saturn and its ring system, and realized that he was then looking through the very same instrument which Keeler had

used years previously to make his memorable discovery of the rotation of Saturn's rings and their relative speeds.

Many of the visitors had retired to their hotels by midnight, but dyed-in-the-wool fans at that time were entertained by an address illustrated with slides from the observatory collection by Mr. Roe, which lasted into the "medium-sized" hours of the morning.

Sunday morning was spent at the discretion of the visitor. Many who had not attended the midnight lecture took advantage of the morning to view the city from some of its surrounding hills.

At 2:00 P.M., the machines were again assembled in front of the hotel, and were escorted again by traffic officers to the Valley View Observatory, home of the Pittsburgh amateurs; here we were greeted by the Stellafane and Chicago groups, who had stolen a march upon the crowd.

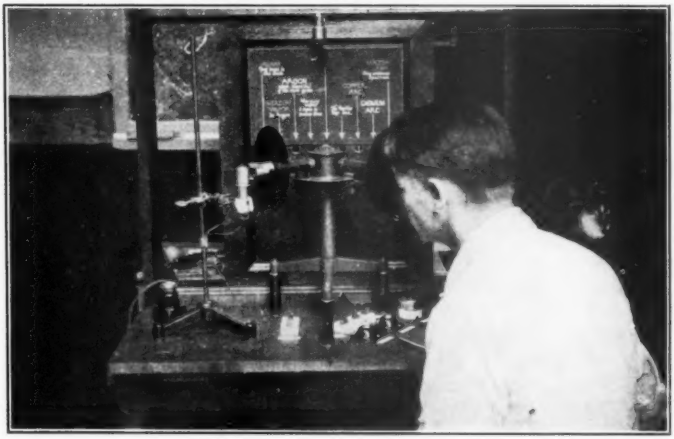


FIGURE 2. THE MCGILL SPECTRA DEMONSTRATOR.

The Observatory, picture of which appeared a few months ago, is made of sheet aluminum, 12 feet in diameter. The dome is free from internal supports, and the smooth interior of the dome has been coated with a non-reflecting paint, upon which background 300 of the visible stars have been indicated with various sized aluminum stars, all in their proper relation and size. This feature of the observatory attracted the attention of visitors, who were able to recognize the constellations without difficulty. Incidentally, these were the only stars seen by visitors on Sunday, due to heavy clouds throughout the day and night.

Probably the most interesting feature of the afternoon program was provided by Mr. W. B. McGill of the Pittsburgh group, who constructed a spectra demonstrator, showing helium, neon, mercury in argon, mercury and argon in uranium glass, air in closed tube, copper and cadmium sparks, and the continuous spectrum from a Mazda bulb. All these tubes were made by Mr. McGill, and the four circuits feeding them were connected by him. The entire machine was made in such a manner that only the switches controlling the various tubes were accessi-

ble to the observer, all wiring and connections being concealed. All tubes were mounted back of a sliding panel, and were visible through a small hole, in front of which was mounted a spectroscope of good dispersion, with a visible scale. Merely sliding the panel across the field of the spectroscope rendered visible all the spectra mentioned, in turn. The demonstrator was used throughout the afternoon and evening, and Mr. McGill was liberally complimented in the ingenuity of his design and the quality of his workmanship by those present who were familiar with spectra.

Mr. Nicklas, aviator of the group, and Mr. Koch, chief photographer, attempted to secure aerial views of the convention, but were twice forced down by low visibility and rains.

A feature of interest to amateurs possessing reflectors, was a demonstration of silvering by the Brashear process. A 10-inch mirror from the main telescope of the Valley View Observatory was cleansed, and while Mr. Scanlon mixed and applied the solutions, Mr. Roe explained the process in detail and answered questions on the processes used by amateurs. A beautifully clear and even coating was secured and, after it had thoroughly dried, it was burnished to a bright surface to illustrate this process.

After refreshments had been served, an illustrated lecture on the progress of the Pittsburgh group was given by C. B. Roe, president. As the lecture was given out of doors, a loud-speaker arrangement was set up by Mr. Marshall and a friend, which materially assisted the audience in hearing the speaker plainly.

The lecture showed the process of grinding and polishing a mirror from the blank-disc stage, through the silvering until established in the tube. Different types of mountings were illustrated, beginning with the simple wood yoke and pipe mounts, up through the machine states, ending with a profession mount. Illustrations of objects as seen through a 6-inch telescope were shown.

The spectrohelioscope being constructed by Mr. Gilchrist was explained, as well as a long-focus solar telescope and camera at Valley View. The building of the observatory was shown from the drawing of the plane, through the erection of the wooden base, to the cutting and fitting of the aluminum sheets, and the final dedication.

Stellar, lunar, and solar photographs taken by various members of the group were shown, as well as methods of taking such photographs with a 6-inch reflector and graflex camera. Places visited by the group were also shown, including Allegheny Observatory, Fecker's, Stellafane, Chicago Planetarium, and instruments located at Seiple's and Donaldson's.

As the night was unfavorable for observation, the convention adjourned until the following year.

LEO SCANLON.

ZODIACAL LIGHT NOTES

By W. E. GLANVILLE.

MORNING ZODIACAL LIGHT.—On September 21 from 4:15 to 4:25 A.M. in a clear sky the Zodiacal Light covered the Leo Sickle then close to the horizon where the Light was about 25° in breadth. Thence it narrowed through Cancer and Gemini to the Milky Way. The main body of the Light was well north of the ecliptic. Regulus was about five degrees north of the clear-cut south boundary. On September 22 in an exceptionally clear sky from 3:40 to 4:15 the Light covered

the Leo Sickle and extended ten degrees beyond it northward. The Light was distinctly pearly in appearance and its brightness was fully equal to the Taurus-Gemini area of the Milky Way.

On October 10 the Light was rather faint at 4:10 but as dawn approached it brightened considerably. The south boundary was sharp, running three degrees south of Regulus; the north boundary was very diffuse, passing just south of Delta Leonis. On October 12 the Light extended from Denebola to the Milky Way in Gemini at 4:20. At 4:35 the Light changed from columnar to a cone. The glare of Jupiter, ten degrees west of Regulus aided the rapid change through Cancer and Gemini. In a few minutes the cone became well defined with the apex at Regulus and Denebola in the middle. Then the base spread north and south with the coming of dawn. On October 13 at 4:15 the Light was strong from the Milky Way through Leo to the horizon. It could be traced arching the sky from Denebola to Pegasus in the northwest but, west of the meridian, it was quite faint. At 4:40 the Eastern Light was again reduced to a cone and underwent a shift of position southward so that Delta Leonis and Denebola were now clear of the Light.

Evening Zodiacal Light.—On October 10 at 7:30 the evening Light was seen bridging the Sagittarius-Ophiuchus gap in the Milky Way and pointing slightly north of Saturn. The evening Light is now beginning to attain a satisfactory angle with the horizon for observation.

Gegenschein.—On September 22 at 4:00 A.M. the Gegenschein was observed with the center south of Algenib; estimated diameter east and west was 20 degrees; boundary was blurred. On October 3 it was seen from 8:20 to 8:45 P.M. on slope towards northeast horizon in Pisces. Delta and Epsilon Piscium were within the luminosity which was elliptical. On October 4 at 8:20 P.M. it was seen elliptical in shape and at 10:45 it was big and round, about 20 degrees east and west and north and south. Clouds interfered at midnight. On October 10 at 4:20 A.M. it was seen very faint in the northwest about 12 degrees along the ecliptic with center about five degrees west of Omicron Piscium; shape, elliptical. On October 13 at 9:30 P.M. it was seen southwest of Gamma Arietis; shape elliptical; diameter along the ecliptic, about 15 degrees.

The observations of October 4 raise the question whether, in the course of the night, the shape of the Gegenschein changes as between, say 9:00 P.M. and midnight and midnight and 3:00 A.M. The phase of the Gegenschein is now changed to the elliptical shape at midnight. At the next vernal equinox when the Gegenschein again attains maximum size attention should be given to this question. Also, if it be a fact that the shape of the Gegenschein changes in our latitudes during the same night, it would be interesting to know if similar changes occur in the tropics. No reports of Gegenschein observations in the tropics are known to the writer. At Quito, 1856-1857, Chaplain George Jones failed to see the Gegenschein. In fact, he was unfamiliar with it as it had been discovered only two years previously by Brorsen. In his Quito report (*Amer. Jour. of Science*, XXIV) Jones says: "A German observer, T. J. C. A. Brorsen of Septenberg says that the place opposite the sun was always brighter than any other part; but, to my eye, it (the Zodiacal Light) always appeared as having a pretty uniform character." It was Barnard who from 1883 to 1920 first made systematic studies of the Gegenschein. For the name Gegenschein we are indebted to Brorsen its discoverer.

The Rectory, New Market, Maryland.

GENERAL NOTES

Professor Willem de Sitter, Director of the Leiden Observatory, delivered a lecture under the Trask foundation at Princeton University on October 27 on "The Size of the Universe."

Dr. Edwin P. Hubble of the Mount Wilson Observatory gave a series of four lectures under the Vanuxem foundation at Princeton University October 29 and 30, November 2 and 3, on the general subject of the nebulae.

The Mont Blanc Astronomical Observatory, built thirty years ago by Professor Vallot, has become the property of the Paris Observatory. It stands at an elevation of 14,435 feet, and will enable astronomers in Paris to undertake researches for which they have not hitherto been equipped. (*Science,* Sept. 25, 1931.)

Godfrey Club Meeting.—Some thirty people gathered at the home of H. D. Gaebler, Watertown, Wisconsin, on Sunday, October 11, for the third annual meeting of the Godfrey Club. Mr. H. L. Schumann, a former naval officer, gave a short talk on the application of astronomy to navigation, and Mr. Joseph Meek of Madison, gave a talk on variable stars and the work of the A.A.V.S.O.

The Eastbay Astronomical Association of Oakland, California, was addressed at its meeting on October 3 at the Chabot Observatory by Captain Ienar E. Elm on certain aspects of astronomy as related to avigation. On October 10, Dr. D. H. Menzel of the Lick Observatory addressed the association on matters relating to designing and using spectroscopes and spectrographs.

The Amateur Astronomers Association, with headquarters at the American Museum of Natural History, New York City, is sponsoring an important series of lectures during this fall. The list comprises the following:

September 16—Dr. Harlow Shapley, "The Harvard Program of Galactic Explorations"; October 7—Dr. E. E. Free, "Cosmic Chemistry"; October 14—Dr. Willem de Sitter (The famous Dutch Astronomer); November 4—Mr. David B. Pickering, "Observatories on the Pacific Coast and in Japan"; November 18—Dr. Clyde Fisher, "Mars, the Ruddy Wanderer of the Sky";December 2—Mr. O. H. Caldwell, "The Electric Eye in Modern Astronomy."

These meetings are held at 8:15 P.M., in the large auditorium of the American Museum of Natural History, 77th Street and Central Park West, New York City.

Aurora Observed.—On the evening of October 12, 1931, while working at the telescope, I noticed a brilliant display of the aurora borealis at about 8:35 P.M., E.S.T. The phenomenon covered about forty degrees in azimuth, α Ursae Majoris being approximately at the center, and extended upward from the northern horizon to a height of from thirty to thirty-five degrees. It consisted of a bright greenish area below and surrounding the bottom of the Big Dipper, and a number of sharp and diffuse vertical streamers of greenish hue whose length ranged from twenty-five to thirty-five degrees. These streamers were quite conspicuous and moved quite rapidly from east to west, continually changing in brilliancy and sharpness; I noticed a particularly bright one which seemed to be in rotation. At about 8:39 the streamers disappeared, the continuous area remaining, however, for per-

haps ten or fifteen minutes longer in gradually decreasing splendor. They again became noticeable at 8:46 but were only about twenty degrees long and lasted for a minute or two.

CHARLES F. JOHNSON, JR.

Princeton, New Jersey, October 13. 1931.

Aurora of June 8, 1931.—On this date at 10:00 P.M., Central Standard Time, the undersigned observed an interesting auroral streamer. The estimated width of the streamer was 5° and the color white like the beam of a searchlight. It extended from ϵ Leonis through Arcturus to β Ophiuchi. It probably extended to both western and eastern horizons but trees prevented my seeing it at low altitudes. The beam appeared remarkably straight and the edges were sharply defined. It was brighter than the brightest parts of the Milky Way. In the course of 15 minutes there was a general southerly drift, the eastern end moving about 2° and the western end about 5°. Twice short side streamers of about 3° length appeared near the center of the main beam and nearly at right angles thereto. Each lasted about half a minute. By 10:20 P.M. the streamer had disappeared.

Northfield, Minnesota. E. A. FATH.

American Section of the International Astronomical Union.—A meeting of the American Section of the International Astronomical Union will be held in Washington, D. C., after the close of the meeting of the American Astronomical Society, December 28-30, 1931.

New statutes of the Section in conformity with the new statutes of the Union will be proposed by the Executive Committee. The Executive Committee does not plan to appoint technical committees of the American Section as was done in preparation for the last two meetings of the Union. Members of the standing committees of the Union are invited to submit to the Executive Cominttee, through the secretary, any matters which they wish to have considered at the meeting.

RAYMOND S, DUGAN.

October 15, 1931. *Secretary.*

Calendar Reform in the United States

The University Association for the Study of Calendar Reform now has a membership representing more than 75 universities and colleges, practically all the leading schools of America being included. As should be the case all opinions on Calendar Reform are represented (see POPULAR ASTRONOMY, Vol. XXXIX, p. 238, April, 1931). During the past summer certain groups in the United States have been canvassed to see whether opinion on the whole favored revision and also to obtain opinions and comments on the relative merits of the more favored 12-month revisions and the 13-month plan. The groups canvassed included the members of the American Astronomical Society, bankers, university and college professors, and transportation executives. Some 1400 replies have been received.

Of these groups bankers are the most conservative and educators the least so. Bankers opposing any revision have a small plurality over those favoring revision and those not answering the question. For the other three groups a good majority favors some revision of the calendar. For all groups the more conservative 12-month revisions are favored by many more than are now advocating the 13-month plan. The ablest minds, however, are not agreed. One can advocate no revision of the calendar, a 12-month revision, or the 13-month plan and still be in agreement with famous men.

The report of the Association giving the results of this canvass was presented on October 12 to the League of Nations committee considering Calendar Reform at Geneva, Switzerland. The report of that committee has not as yet been received but the opinion of the officers of the Association is that because of lack of agreement, no important action can be taken at this conference.

CLIPPING FROM DES MOINES REGISTER, TUESDAY, OCT. 20, 1931.

Geneva (AP).—The International Calendar Reform conference Monday (October 19) adopted a declaration favoring the stabilization of Easter, postponed the question of generally simplifying the calendar, and adjourned.

The conference declared the stabilization of Easter was desirable "on account of the social and economic disadvantages of its present wandering date." The Sunday after the second Saturday in April was preferred by most delegates.

The Swastika or Sun-Emblem

The swastika symbol, consisting of a double (capital) gamma cross and sometimes also written as two identical S curves intersecting in the middle and setting at right angles, has a very wide range in religious emblems of China and India and is met with in prehistoric monuments in Europe, Asia, and America. Invariably it is associated with the worship of Aryan sun-gods and the best scholarship considers it to be a representation of the sun. It is quite possible that this symbol is an authentic record that has come down to us from the urwelt of a time when the sun, due to a tremendous external disturbance making it at least on a small scale a nova, threw out great spiral arms which became visible to primitive man, from amid clouds of fiery vapors as the disturbance began to wane. Hence man interpreted the sun with its spiral arms as a favorable omen that the worst was over and thence came the association of the symbol with well-being. Cosmogonists have speculated that the sun might throw out two spiral arms under certain circumstances while the swastika, representing the sun, suggests that there were quadruple spirals which were a good deal of the same shape as Airy's spirals.

J. B. PENNISTON.

Seattle, Washington.

Comet Discoverer Grows Cantaloupes.—M. Nagata, discoverer of a new comet, is a quiet and deeply studious man earning his living as a foreman for the Sears brothers, cantaloupe and lettuce growers near Brawley, California.

When Nagata was informed that astronomers at Mt. Wilson and Washington, D. C., had declared his discovery was authentic and that the new comet would be named in his honor, he remarked,

"They should call it after some better man."

Nagata has made no definite study of astronomy but his father was greatly interested in it in Japan and the son came by his talent naturally.

He is a bachelor and spends most of his spare time with his instruments scanning the skies. He is highly regarded by his employers and his countrymen.

Correction.—By a strange mistake line 3 on page 467 (October, 1931) was repeated as line 26 on the same page. Line 26 should have been "average would be 6 stars. The ratio of the summations at 6.5 and 7½," which makes the sentence intelligible. We regret this error and hope this correction will come to the attention of those who were confused by it.

BOOK REVIEWS

Gechichte der Sternkunde, by Prof. Ernst Zinner, (Springer-Berlin, 1931. 673 pages. Price 21.80 marks.)

This volume is not merely a history of astronomy but also includes the history of astronomical thought and concepts such as space and time. The book is divided into various parts which deal with the astronomy of the Egyptians, Babylonians, Greeks, Romans, Jews, Persians, Chinese, Tibetans, Indians, and Siamese, Savage races, Mayans, Arabs, Nordic peoples, Celts and Slavs. It also contains an extensive bibliography on the history of astronomy and biographies of important astronomers. There are 54 illustrations in the text and 13 plates.

The subdivisions of the section on Egyptian astronomy will illustrate the treatment of the material. The first part deals with the concept of time and is divided into time reckoning and time measurement by means of water clocks, solar clocks, and star clocks. The second part deals with the concept of space and is divided into the knowledge of the earth, directions and fundamental planes, the motions of the heavenly bodies and the stars. The third part deals with scholars and instruction while the last part describes observatories and scientific instruments.

The book contains a wealth of material and will be valuable to anyone interested in the subject. The moderate price will no doubt aid in a very general distribution among the astronomically minded who can read German.

E.A.F.

Opticks; or, A Treatise of the Reflections, Refractions, Inflections and Colors of Light, by Sir Isaac Newton. Reprinted from the 4th ed. (1730) with a foreword by Prof. Albert Einstein and an introduction by Prof. E. T. Whittaker (414 pages, diagrams, McGraw, 1931).

In the introduction Professor Whittaker, himself an authority on optical theory and on history of theories of the ether, discusses the rehabilitation of the corpuscular theory of light, the overthrow of which did so much to place Newton's writings under an eclipse for a hundred years. He also mentions Newton's hypothesis of gravitation which is given at length in Query 21 of Book III. It is not generally known that Newton formed an hypothesis as to the nature of gravitation. Not only did he do so but his ideas on the subject place him among the exponents of the kinetic (or pressure) theories of gravitation. His hypothesis in *Opticks* should be compared with that in his letter to Robert Boyle. (See Sir David Brewster, *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton,* 1:418-419.) Along this same line do not overlook the advertisement to the second edition (p. xxix in the new book) where Newton says he does not consider gravity an essential property of bodies. It is of interest to compare this statement and the discussion in Query 21 with Einstein's assertion in *Relativity* (p. 24): "The action of the earth on the stone takes place indirectly. The earth produces in its surroundings a gravitational field, which acts on the stone and produces its motion of fall."

The first two books of *Opticks* stick very closely to the practical results of the author's investigation of his subject but the third and last book, consisting of thirty-one queries, is a sort of intellectual gold mine, written by the greatest genius that the English speaking race has yet produced. It is a mixture of speculation

and hypotheses on many subjects, including biology and theology. It contains a number fo important points of which the writers of textbooks are apparently ignorant. For instance, there is a definition of the sense in which Newton used the word *attraction*, a definition which is also given in *Principia*, Book I, Scholium at end of Section XI, in slightly different language but to the same effect. In the same query there is also a discourse on method, in which he in substance repeats his fourth rule of reasoning in philosophy, given at the beginning of Book III in *Principia*. The gist of this method which Newton declares he employed in developing the subject matter of the first two books of *Opticks*, is that we are not to evade the argument of induction by the use of hypotheses. Newton, the author of the famous remark "Hypotheses non fingo," did use hypotheses but he scorned them, as his overstatement indicates, as a substitute for facts, or the phenomena as he would call them.

The publishers are to be congratulated on the production of this well-printed work which meets a genuine need as many well-appointed libraries unfortunately do not have copies of Newton's writings. J.B.P.

The Dynamic Universe, by James Mackaye. (308 pages, Scribner, 1931, $3.50.)

Mr. Mackaye, a lecturer on philosophy at Dartmouth College, has written a critique upon the new physics. With modest good sense and without mathematical technicalities he has stated his objections to the way the relativists have managed to bewilder themselves and others on the subject of the ether. Most of them having abolished the ether, they have been compelled to bring it back, charges Mr. Mackaye, "in a more fantastic form," calling it an "unique frame of reference." But his criticisms are not entirely destructive as he thinks there is some physics combined with the metaphysics and some truth obscured by untruths in the teachings of Einstein. The author also has something to say on his own account, regarding a theory of ethereal radiation with relation to the structure of matter. The book is decidedly worth reading. J.B.P.

Publications Received

1. Publications of the University Observatory at Berlin-Babelsberg, Volume VIII, Part 2. Beitrag zur Photometrie der Südlichen Milchstrasse und des Zodiakallichts, by C. Hoffmeister.
2. Same as above—Part 3. Untersuch über das Deklinationssystem des neuen Fundamentalkalatogs, by G. Schneider.
3. Streams among Stars with Large Proper Motions, by W. Gyllenberg, Ser. II, No. 57, Lund Observatory.
4. Lund Observatory Circular, No. 3, containing seven papers.
5. Annals of the Observatory of Lund, No. 2, containing an extended paper by Per Collinder entitled "On Structural Properties of open Galactic Clusters and their Spatial Distribution." This is the second in a new series of publications from the Lund Observatory in quarto size.